REPORT, RETURNS AND STATISTICS

OF THE

INLAND REVENUES

OF THE

DOMINION OF CANADA

FOR THE FISCAL YEAR ENDED JUNE 30

1903

PART III

ADULTERATION OF FOOD

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1904

No. 14—1904

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REPORT

OF THE

DEPUTY MINISTER OF INLAND REVENUE.

INSPECTION OF FOODS, DRUGS AND FERTILIZERS.

To the Honourable M. E. Bernier,
Minister of Inland Revenue.

Sir,—I have the honour to submit herewith the reports of the official analysts of the Dominion for the fiscal year ended June 30, 1903.

The following is a summary statement of the whole number of samples analysed by them :—

Description of Samples.	Genuine.	Adulterated.	Doubtful.	Total.
Fertilizers	67	5	4	76
Paris Green	83	2	2	87
Total	150	7	6	163

The following is a summary of the number of samples analysed by the chief analyst and his staff at the laboratory at Ottawa.

Description of Samples.	Genuine.	Adulterated.	Doubtful.	Total.
Unfermented grape juice	9	6	0	15
Wine	2	1	0	3
Lime juice	20	7	0	27
Catsup	7	8	9	24
Cereal foods	20	0	0	20
Canned meats	94	5	0	99
Canned vegetables	98	2	0	100
Fertilizers	15	1	0	16
Paris green	71	2	1	74
Total	336	32	10	378

Besides the foregoing, 40 samples of fertilizers and seven samples of Paris green, the duplicates of which were examined by district analysts, were also analysed at the laboratory in Ottawa.

The following statement shows the total number of samples examined during the fiscal year ended June 30, 1900, 1901, 1902 and 1903 respectively :—

	During the Fiscal Year ended June 30.			
	1900.	1901.	1902.	1903.
1. Number of samples collected by the food inspectors for examination	895	885	883	541
2. Number of these samples examined by the public analysts.	756	881	883	163
3. Number of these samples examined in the laboratory here.	181	243	270	425
4. Number of samples examined at the laboratory here, duplicates of which were not analysed by the public analysts.	730	802	600	1,017
This number however includes the following :—				
Samples of beer	44	25	32	70
" vinegar	360	413	346	366
Standard fertilizers	107	102	106	128
Samples examined for other departments :—				
Marine and Fisheries	1	3	15	8
Public Works	0	0	3	0
Militia and Defence	2	0	3	16
Indian Affairs	0	0	6	2
Agriculture	0	0	15	3
Police Branches	1	1	1	0
Interior	0	0	2	0
Trade and Commerce	0	2	0	0
Railways and Canals	0	0	0	97
Customs	0	0	0	4

I have the honour to be, sir,

Your obedient servant,

W. J. GERALD,

Deputy Minister.

INLAND REVENUE DEPARTMENT,

OTTAWA, Dec. 28, 1903.

REPORT OF CHIEF ANALYST.

317 Queen Street,
Ottawa, December 12, 1903.

W. J. Gerald, Esq.,
Deputy Minister of Inland Revenue,
Ottawa.

Sir,—In accordance with your request of 1st inst., I beg to supply the following statement as regards the examination of food and other samples in this branch during the year ended June 30, 1903.

1. Number of samples collected by the food inspectors for examination	541
2. Number of these samples examined by the public analysts.	163
3. Number of these samples examined in laboratory here	425
4. Number of samples analysed in the laboratory here, duplicates of which were not examined by the public analysts.	1,017

This number however includes the following :—

Samples of beer	70
Samples of vinegar	366
Standard fertilizers	128

Samples examined for other departments :—

Marine and Fisheries	8
Railways and Canals	97
Militia and Defence	16
Indian Affairs	2
Agriculture	3
Customs	4

I have the honour to be, sir,
Your obedient servant,

THOMAS MACFARLANE,

REPORT OF PUBLIC ANALYSTS.

66 Bedford Row,
Halifax, N.S., November 23, 1903.

The Deputy Minister of Inland Revenue,
Ottawa.

Sir,—I have the honour to submit my annual report on the samples of food, &c., received for analysis under the Adulteration Act during the year ending June 30, 1903,

—	Genuine.	Not registered.	Adulterated.	Total.
Fertilizers	12	2	1	15
Paris green	20	...	1	21
Total	32	2	2	36

I have the honour to be, sir,
Your obedient servant,

MAYNARD BOWMAN,

112 St. François-Xavier Street,
Montreal, November 25, 1903.

The Deputy Minister,
Inland Revenue Department.
Ottawa.

Sir,—I have the honour to present my report on the analysis of samples which have been submitted to me by your department, during the fiscal year ending June 30, 1903.

I have analysed 26 samples in all, namely : 10 samples of fertilizers and 16 samples of Paris green.

Of the fertilizers one sample was in my opinion adulterated according to the Act, in that it contained over one per cent less than the guaranteed percentage of total phosphoric acid without equivalent compensation in the form of an excess of other ingredient. The other nine samples I have reported as genuine.

Of the 16 samples of Paris green one was found to be adulterated with barytes and sulphate of lime. The remaining 15 are genuine.

I have the honour to be, sir,
Your obedient servant,

J. T. DONALD.

FACULTY OF APPLIED SCIENCE AND ENGINEERING, UNIVERSITY OF TORONTO,

TORONTO, 4th December, 1903.

To the Commissioner of Island Revenue,
Ottawa.

SIR,—I beg to submit the following report of the work done in my district during the past year.

During this year twenty-six samples have been submitted to me by the inspectors under the Act; of these sixteen were samples of Paris green, and ten, samples of fertilizers.

The results of the analysis of these samples are given below in tabular form :—

—	Unadulterated.	Adulterated.	Doubtful.
Paris green	14	..	2
Fertilizer	5	3	2
Total	19	3	4

Two samples of Paris green contained an excess of arsenic over that required. These are reported doubtful.

Three samples of fertilizer were reported as below the standard, and two which were not registered were classified as 'doubtful.'

I have the honour to be, sir,
Your obedient servant,

W. H. ELLIS.

282 ASSINIBOINE AVENUE,
WINNIPEG, MAN., NOV. 21, 1903.

The Commissioner of Inland Revenue,
Ottawa.

SIR,—I have the honour to report that during the past year I have analysed 15 genuine samples of fertilizers and 18 of Paris green.

I have the honour to be, sir,
Your obedient servant,

EDGAR B. KENRICK.

PUBLIC ANALYST'S OFFICE, VICTORIA, B.C.,
November 25, 1903.

To the Commissioner of Inland Revenue,
Ottawa.

SIR,—I beg to submit report for year ending June 30, 1903.

Samples.	Genuine.	Adulterated.	Total.
Paris green	16	0	16
Fertilizers	26	0	26
Total	42	0	42

The fertilizers were in some instances so badly mixed that an injustice is almost sure to result.

I have the honour to be, sir,
Your obedient servant,

C. J. FAGAN,

APPENDIX A.

BULLETIN No. 82—UNFERMENTED GRAPE JUICE.

OTTAWA, November 12, 1902.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR,—I beg to submit herewith a schedule giving the results obtained in this laboratory from the examination of certain samples of unfermented grape juice, collected in accordance with your instructions of July 3 last. Two additional samples were collected in the Calgary district, but lost in transit. Of the 18 samples actually examined it will be seen that three were fermented wines, no doubt taken by the food inspectors through inadvertence. Among the remaining samples of unfermented grape juice four contained small quantities of alcohol, and in three cases the quantity was nigher than the legal limit allowed in England for 'herb, ginger and botanic beers,' which is 2 p. c. proof spirit. The samples in question are:—

No. 21233 with 3·30 p. c. proof spirit.
21235 " 3·03 " "
21679 " 2·34 " "

It has also to be pointed out that of the 15 samples of unfermented grape juice, 9 have been found genuine and 6 to contain salicylic acid as preservative. As to whether the use of salicyclic acid in unfermented wine is permissible, it may be profitable to quote from a recent work on standards of purity for foods and drugs by C. J. Moor, a public analyst, and author of several works on food analysis in London, England. On preservatives generally Mr. Moor writes as follows:—

'The question as to the propriety of adding preservatives to foods is one which has excited much attention, and is still a source of frequent contention. Some analysts do not regard the addition of preservatives as constituting adulteration, while others do.

'The question appears to have a different bearing according to the kind of article in question, and preservatives should be allowed in some articles (but their presence should be in all cases acknowledged), and in certain others they should not be allowed in any circumstances.

'In the case of those articles in which they are allowed, a limit should be agreed on of those preservatives which are generally considered to be harmless, and official methods should be published for their estimation.

'In the case of those articles which can be readily made and sold without any addition of preservatives, I consider that they ought to be preserved by sterilization alone.'

The last paragraph applies in the present case, for the results now reported prove that unfermented grape juice can be made and kept for sale without any addition of preservatives.

As to whether salicylic acid may now be legally used as a preservative, this appears to be forbidden by section 2 (e) (6) of the Adulteration Act, which provides that food shall be considered adulterated if it contains any ingredient which may render it injurious to the health of the person consuming it. It would, however, be a difficult matter to prove the injurious character of small admixtures of salicylic acid, and authorities are divided in opinion on the subject. By section 17, as amended, salicylic acid is mentioned (in the first schedule of the Adulteration Act) among those substances which, if added to alcoholic, fermented or other potable liquors, would cause them to be regarded as injurious to health. Since unfermented grape juice may reasonably be included among 'other potable liquors,' it is thus evident that the addition of salicylic acid is contrary to law.

I have the honour to be, sir,
Your obedient servant,
THOS. MACFARLANE.
Chief Analyst.

RESULTS of Analysis of Eighteen Samples of Unfermented Wines

Date of Collection.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher.	No. of Sample.
1902.			
July 31	G. E. Hughes, Charlottetown, P.E.I. . .	Welch Grape Juice Co.	4307
" 31	J. G. Jamieson, Charlottetown, P.E.I.	" "	4316
Aug. 7	Methodist Bookroom, Halifax, N.S.	Hagar Bros., Welland, Ont.	20233
" 7	Brown & Webb, Halifax, N.S.	Welch Grape Juice Co., Westfield, N.Y. . .	20234
July 23	E. Clinton Brown, St. John, N.B.	Hagar Bros., Welland, Ont.	17847
" 25	C. P. Clarke, St. John, N.B.	Welch Grape Juice Co., Westfield, N.Y. . .	17849
" 23	G. Dupuis, St. John, Que.	The Ontario Grape Growing and Wine Manufacturing Co., St. Catharines.	23335
" 24	F. Poitras, St. Hyacinthe	S. Ernest Maranda, St. Hyacinthe	23336
" 22	J. T. Lyon, Bleury St. Montreal.	Welch Grape Juice Co., Westfield, N.Y. . .	21224
" 25	M. McMillan, Brockville, Ont.	Turner & Co., Toronto.	21233
" 25	J. A. Johnston, Brockville, Ont.	F. A. Lytle & Co., Toronto.	21235
" 31	Hagar Bros., Welland	Hagar Bros., Welland	21237
Aug. 1	Michie & Co., King St., Toronto.	F. A. Breck, Vineland, N.Y.	21240
July 23	D. Rush, Wingham, Ont.	Turner & Co., Toronto.	22039
" 23	B. B. Gunn, Seaforth, Ont.	Chautauqua Fruit Co., Ripely, N.Y. . . .	22041
" 31	McNab & Roberts, Winnipeg, Man.	J. J. McLaughlin, Toronto	17424
" 31	McDowell Watson Co., Vancouver.	Tokay Wine Co., Gennesse, N.Y.	21679
" 31	" "	K. Campbell, Montreal.	21683

(Grape Juice) examined specially for Alcohol and for Antiseptics.

Acidity ; Grammes per 100 C.c.			Density of				
Total as Tartaric Acid.	Fixed as Tartaric Acid.	Volatile as Acetic.	The Wine.	Distillate to Equal Volume.	Alcohol p. c. by weight.	Antiseptic Found.	Remarks.
0·690	0·330	0·288		0·9998	Trace.	None	Genuine.
0·615	0·600	0·012		0·9998	Trace.	None	"
0·405	0·150	0·204		0·9999	Trace.	None	"
0·900	0·150	0·600		0·9998	Trace.	None	"
0·495	0·060	0·348		1·0000	None.	None	"
0·705	0·690	0·012		0·9998	Trace.	Salicylic acid.	Contains salicylic acid.
0·720				0·9841	10·00		Samples of Canadian wines collected by mistake.
0·540				0·9787	14·18		
0·825	0·555	0·216		0·9998	Trace.	None	Genuine.
0·720	0·555	0·132		0·9973	1·50	Salicylic acid.	Contains salicylic acid.
0·645	0·465	0·144		0·9975	1·37	"	"
0·375	0·375	None.	1·1008	0·9998	Trace.	None	Genuine.
0·525	0·525	None.		0·9998	Trace.	None	"
0·780	0·540	0·192		0·9984	0·84	Salicylic acid.	Contains salicylic acid.
0·420	0·345	0·060	1·0792	0·9997	Trace.	None	Genuine.
0·990	0·165	0·660	1·0971	1·0000	None.	Salicylic acid.	Contains salicylic acid.
0·630	None.	0·504	1·1227	0·9980	1·06	"	"
0·600	None.	0·480	1·1136	0·9844	9·79	"	Is a fermented wine.

APPENDIX B.

BULLETIN No. 83—LIME JUICE AND CATSUP.

OTTAWA, December 151902.

W. J. GERALD, Esq.,
Deputy Minister Inland Revenue.

SIR,—I beg to transmit herewith a report of Mr. A. McGill, M.A., assistant analyst to the chief analyst, on Lime Juice and Ketchup or Catsup together with tabulated statements of the analytical results obtained by him in this laboratory, which also show the nature and origin of the different samples examined.

I have the honour to be, sir,
Your obedient servant,

THOS. McFARLANE,
Chief Analyst.

LABORATORY OF THE INLAND REVENUE DEPARTMENT,
OTTAWA, November 25, 1902.

THOS. MACFARLANE, Esq., F.R.S.C.,
Chief Analyst.

SIR,—I beg to submit my report upon Ketchup and Lime Juice, together with a memorandum in which I have endeavoured to present, as clearly as I can, the state of existing knowledge on the subject of preservatives in food and of artificial colouring matters therein.

I have the honour to be, sir,
Your obedient servant,

A. McGILL.

LABORATORY OF THE INLAND REVENUE DEPARTMENT,
OTTAWA, November 24, 1902.

MEMORANDUM accompanying a report upon 24 samples of Ketchup and 27 samples of Lime-juice.

In these reports, as well as in that concerning unfermented grape juice (18 samples) which I handed in on the 27th ult., I have specially kept in view the detection of chemical preservatives and of artificial colouring matters.

Although I have, in most cases, made these determinations quantitatively, I prefer, in these reports, merely to state the presence or absence of the preservative, or colouring

matter, without giving any statement of the quantity found. It is well known (see paragraph 75, Report of the British Food Commissioners, and elsewhere) that quantitative methods for the estimation of preservatives and colouring matters in foods, are far from being perfect. Work is being done in this laboratory, and in all national food laboratories, with a view to perfecting methods of research ; and there is little doubt that methods commanding universal acceptance and recognition will soon be available. Meantime, our qualitative processes are above suspicion, and the presence of these antiseptics and dyestuffs can be ascertained with absolute certainty in most cases. The following note shows that it is not only the peculiar nature of the food stuff, which may present difficulties to the analyst, but that manufacturers of preservatives seek, by making these as complex as possible, to hamper the search for them, in food.

In November, 1898, (Analyst, 1898, p. 309) A. C. Chapman, F. I. C., called the attention of the British Society of public analysts to the fact that very complex mixtures were sometimes put on the market as food preservatives. He had found one which contained sulphate of alumina, chloride of sodium, nitrate of sodium, sulphurous acid, chloral hydrate, benzoic acid and iodine, the last probably as hydriodic acid.

Dr. Rideal, in discussion, said that he had met with several such complex preservatives, which he asserted to be almost invariably of French origin, and probably intended to baffle analysts through the introduction of a large number of ingredients.

In a few of the ketchups it will be seen that two different preservatives are present ; but for the most part I find that a single substance of the kind is employed.

The extensive use of chemical preservatives in perishable foods is one of the most noteworthy features of our time. That the use of antiseptics is very general, is proven by the result of our own experience, and by the various reports issued by the governments of civilized countries, which make official investigation of foods and drink sold in the open market.

This is illustrated in a forcible way by the report of A. E. Leach, of the State Board of Health, Massachusetts (Analyst, 1901, p, 289). During the summer months of 1898, 1899 and 1900, 5,169 samples of milk were examined for preservatives, and 179 samples, or 3·5 per cent. of the whole number, were found to contain such. Of this number 142 contained formaldehyde, and 30 contained boracic acid.

In the Report of the Conn. Agri. Expt. Stn., for 1899 (p. 139) after a summary of reasons for condemning the wide-spread use of chemical preservatives in food, occurs the following :—

The Station has secured a considerable number of the advertised preservatives, and these have been qualitatively and as far as possible quantitatively analyzed. Results of analysis are as follows :—

'Freezine'—B. Heller & Co., Chicago—A 5·19 per cent. solution of formaldehyde.
'Iceline'—Heller Chemical Co., Chicago—is 1·92 p.c., formaldehyde.
'Special M. Preservaline'—A solution of formaldehyde, 1·99 per cent.
'Rex Magnus, Snow Flake Brand'—Contains 78·15 per cent. boric acid.
'Rex Magnus, Pearl Brand'—Contains 95·72 per cent. boric acid.
'M. Preservaline'—Contains 97·81 per cent. boric acid.
'B. B. Preservaline'—Contains 65·42 per cent. boric acid.
'Preservaline Butter Powder'—Is merely bi-carbonate of soda.
'Cream Albuminoid'—Contains 50·4 per cent. boric acid.
'Preservaline for Cider'—Is salicylic acid only.
'Blue Seal Preservative'—Contains 70·24 per cent. salicylic acid.
'Forman's Cider Preservative'—An alcoholic solution of beta-naphtol.
'Preservite'—Contains 96 per cent. benzoate of soda.
'Forman's Preservative for Wine'—Contains 36·13 per cent. formaldehyde.
'Compressed Preserving Powder for Beer'—Contains 49·01 per cent. of salicylic acid.
'Emken's Preserving Cakes'—Contained 22·09 per cent. salicylic acid.
'A Boake Roberts and Co's., K.M.S.'—Tablets containing 84·35 p.c., bisulphite.
'K. M. S. Preserving Powders'—Contained 25·47 per cent. bisulphite.

'Rex Magnus, Viandine Brand'—Contained 81·77 per cent. boric acid.
'Sportsman's Rex'—Same composition as last.
'Ocean Wave Brand'—Contained 88·85 per cent. boric acid.
'A' preservaline for sausages—Contained 68 per cent borax.
'Freeze-Em'—Contains 29·19 per cent sulphurous acid.
'Maas and Waldstein's Preserving Salts'—Six samples contained from 29·05 to 33·16 per cent boric acid.

Sulphurous acid has been reported in dried fruits, chiefly American, by Beythien and Bohrisch (Zeit. für Untersuch. der Nah. und Genussmittel, 1902, 401)—Californian apricots contained from 0·216 to 1·158 per cent, (calculated as crystallized sodium sulphite) peaches, 0·992 per cent, pears 0·2399 per cent—Italian prunes contained 0·264 per cent.

The most largely used preservatives are undoubtedly salicylic acid, formaldehyde and boracic acid; but new substances are being added to this list from time to time. Thus sulphurous acid and sulphites, benzoic acid, fluoride of sodium and many other articles of an antiseptic character are quite frequently reported and according to A. H. Allen (Analyst, 1902, 178)—the use of silico-fluoride of sodium as a preservative is patented in England, and the compound is manufactured to a considerable extent at Warrington.

The following extract is from the Report of the Massachusetts State Board of Health, 1899—p. 614:—

'The manufacturer of a largely used preservative, known as 'Freezine' (which is a weak solution of formaldehyde) issues an attractive pamphlet in which he makes the following remarkable claims.' It is not an adulterant.—It immediately evaporates, so that no trace of it can be found, as soon as it has rendered all the bacteria inert. No chemical analysis can prove its presence in the milk quantitatively or otherwise.' Its use in milk is also claimed by the manufacturer to be beneficial to the health of infants, many of whom have been saved from sickness and even death, he alleges, by a liberal use of 'Freezine' in the milk.'

Probably the newest suggestion for a preservative for milk is that of Jablin Gonnet—(Ann. Chim. Analyt., 1901, 129—through the Journ. Soc. Chem. Indust., 1902, 420) who states that '1 c.c. of a 12 per cent. solution of hydrogen peroxide added to 1litre of milk, prevented spoiling for two days; 2 c.c. for four days and 6 c.c. for six days, at a temperature of 20° C=68° F. The hydrogen peroxide cannot be tasted in the milk, and according to a series of physiological experiments, is harmless to the human system.'

National attention in England was drawn to the matter in 1897 by the 'Lancet,' which issued a circular letter to certain very eminent physicians, for the purpose of securing expert opinion on the whole subject.

This circular proposed the following questions:—

(1) Is the presence of small quantities of salicylic, boric or benzoic acids or formaline in food, in sufficient quantities to preserve it, injurious to health?
(2) Should the use of antiseptics for this purpose be forbidden by law altogether?
(3) Should legislation be brought to bear on the restriction of the amount?
(4) Should the law insist that when preservatives are used the fact should be stated on the label?

Sir Henry Thompson wrote that 'he had long held that the addition of antiseptics was undesirable, though unable to produce evidence that any one of them had given rise to deleterious action owing to the impossibility of isolating the precise influence of the drug. He objects strongly to the dietetic use of drugs, and is of opinion that the name and quantity of the antiseptic employed should be on the label, or on a paper setting forth the maker's or vendor's name.'

Dr. Pavy wrote that 'he did not consider our knowledge sufficiently extended to permit of its being taken for granted that no injury is producible, though there is no evidence of injury to health. He points out that it is the vendor, and not the consumer, that is benefited. He considers that, notification of the fact of antiseptics being employed, and their nature and amount would be sufficient: any deviation from the notification

should be liable to prosecution. With the public interest thus safeguarded, he thinks that advantage might be taken of the power of antiseptics in preserving articles of food.'

Dr. F. J. ALLEN points out the possibility of daily accumulation of antiseptics quite sufficient to produce a gradual lowering of the standard of health, and is of opinion that the fact of an antiseptic being added, and its nature, should be required by law to be announced at the time of sale.

Dr. SIMS WOODHEAD draws attention to idiosyncracy and cumulative effect, and dwells upon our ignorance of the action of certain drugs (*e.g.*, formalin) on food stuffs. He points out that by the use of preservatives foods of inferior quality may be doctored. He would make the use of antiseptics illegal unless their nature and quantity be made known.

The late Sir B. W. RICHARDSON considered that antiseptics are not only necessary at this moment, but when used in proper form and quantity cause no injury whatever. There ought to be a license given permitting a certain fixed, and not a dangerous, quantity of antiseptic, and it ought to be stated on the label what the antiseptic is and its quantity.

Dr. T. LAUDER BRUNTON writes that 'one must remember that poisons are formed in foods by spontaneous decomposition, which may take place after purchase. The question to be decided comes to be whether antiseptics are likely to be more injurious to health than the natural products of decomposition. His own belief is that preservatives are the less injurious. His answers are: (1) The use of antiseptics should not be forbidden by law. (2) It is doubtful whether legislation should restrict the amount, as the makers will probably use the minimum amount found sufficient. (3) The fact of preservatives being used, and their amount, should be stated on the label.'

Sir W. ROBERTS says that 'there is no reliable information available, and an inquiry is needed.'

Dr. W. D. HALLIBURTON is not able to give information as to injurious effects from his experience, but quotes F. J. Allen as mentioning cases of ill health in children due to boric acid.

Dr. J. R. BRADBURY thinks that 'it is not necessary to forbid antiseptics, but that the amount should either be restricted, or the fact of their addition stated on the label.'

Dr. WHITELEGGE cannot speak positively, though it is clear to him that the law should insist upon a plain statement on the label if any preservative be added.'

I am tempted to make one remark in connection with the report of Dr. Brunton.

The claim that antiseptics should be used in perishable foods because they are less injurious to health than the poisonous products of the spontaneous decomposition of these foods, seems to me quite untenable. The decomposition of food should be a fact of exceptional occurrence, and such food should be rejected altogether; whereas the systematic addition of an antiseptic to food, in order to prevent decomposition, would result in the habitual dietetic use of a powerful drug.

Recognizing the national importance of the problem, a departmental committee was appointed in July, 1899, to report to the British Parliament upon the following subjects:—

1. Whether the use of such materials (preservatives and colouring matters) or any of them, for the preservation and colouring of food, in certain quantities, is injurious to health, and if so, in what proportions does their use become injurious.

2. To what extent, and in what amounts, are they so used at the present time.

The committee consisted of the Right Honourable Sir H. E. Maxwell, Bart., M.P.; Professor T. E. Thorpe, C.B., D.Sc., F.R.S.; Dr. T. H. Bulstrode and Dr. F. W. Tunnicliffe.

The committee reported to parliament in the following year; and as the evidence taken represents the knowledge of the scientific world upon the subject of preservatives, up to the year 1900, it may be well to make some extracts from the report as presented. This report together with the minutes of evidence and appendix, forms a closely printed volume of 497 folio pages, 'From the evidence brought before the Committee it would

appear that, at the present time, the only artificial or chemical antiseptic agents other than oils, spirits of wine, vinegar, salt, sugar, etc., employed, or said to be employed, in the preservation of food are :—

Boric or boracic acid and borates ; so-called 'boron preservatives'.
Sulphurous acid and sulphites.
Fluorides.
Salicylic acid.
Benzoic acid or benzoates.
Formalin or formaldehyde.

'As regards fluorides, benzoic acid and the benzoates it may be said at once that, if employed at all, their use must be extremely limited. Mr. Leonard Boseley, Analyst to Messrs. Keiller and Son, Limited, stated that he believed that a firm in London were trying to get benzoate of soda taken up as a preservative for jams.

'The boron preservatives are generally sold in the form of a white powder (sometimes however coloured with a coal tar dye) under a great variety of fanciful names, which as a rule afford no clue to their real nature. They are used largely for dairy produce, for margarine, ham, bacon, sausages and preserved meat foods generally, and to a much smaller extent in beverages.

'Salicylic acid comes next in the extent to which it is used. It is employed chiefly in beverages and in foods derived from fruit.

'Formalin, which is of comparatively recent introduction consists of a 40 per cent. solution of formaldehyde in water. The solution is diluted to various strengths, and sold as a preservative for milk chiefly, and to a less extent for other foods.

'Sulphites are used for very much the same purposes as salicylic acid, especially by brewers. They are also employed by butchers, and to a less extent by game and poultry dealers.

'As the result of an inquiry among a large number of farmers and dairymen, 110 replies were received, and 65 of these admitted the use of preservatives.

Of 4,251 food samples examined for the Committee in the government laboratory, 1,659 samples (=39 per cent.) were found to contain preservatives, as follows :—

Boric acid	1,247	samples.
Salicylic acid	320	"
Formalin	20	"
Sulphites	143	"

(71 samples were found to contain two preservatives of different kinds.)—

Of	290	samples of cream,	77·9	p.c. contained preservatives.
"	364	" butter,	57·1	" "
"	210	" bacon,	70·5	" "
"	185	" ham,	82·7	" "
"	226	" sausages,	66·4	" "
"	48	pork pies,	70·8	" "
"	150	samples jam	44·0	" "
"	78	" lime & lemon juice	88·5	" "
"	769	" temperance drinks	26·1	" "
"	100	" imported beers	39·0	" "

'A comparison of the percentages of preservatised foods in the poorer districts and the wealthier districts of London, respectively, shows that they are practically identical, being 42·9 per cent in the former and 43·4 per cent in the latter.

'Preservatives are extensively used in certain foods imported into the United Kingdom from the colonies and foreign countries, especially in butter from Australia, in ham and bacon from Canada, and in butter and margarine from France, Holland and Belgium.

'Of the temperance beverages received from all parts of the United Kingdom, 83·5 per cent of those sold as temperance 'wines' and cordials, contained preservatives' chiefly salicylic acid, and to a less extent sulphites,

'With regard to the amount of the several preservatives, it appears that the boracic acid in the milks varied from 1·3 to 9·1 grains per pint; in cream from 10 to 57 grains per pint; in sausages, potted meats and brawn, from 15 to 66 grains per pound; in butter from 18 to 65 grains per pound; in bacon from 8·6 to 46 grains per pound. The amount of salicylic acid in jams varied from 1·7 to 8·5 grains per pound; in temperance drinks and cordials from 1·5 to 19 grains per pint; in herb beers and similar beverages from 0·5 to 8·1 grains per pint; and in imported beers from 1·3 to 3·4 grains per pint. Sulphites were found to be contained in lime juice, ginger wine, lemon syrup, raspberry and peppermint cordial in amount (estimated as sulphur dioxide) varying from 0·1 grain to 4·5 grains per pint.

'Mr. Vasey, who has been employed for upwards of ten years to examine foods and beverages on behalf of the 'Lancet', stated that he had found boric acid in meat peptone and beef jelly intended for invalid use, and that practically all the samples of invalid foods which he had occasion to analyze contained chemical preservatives.

'Dr. Voelcker testified from personal observation, to the casual and haphazard manner in which both farmers and vendors add preservatives to milk.'

COLOURING MATTERS.

'The crude and gross sophistication of foods with mineral colouring matters, known to be more or less poisonous, appears to be a thing of the past.

'Sulphate of copper is, however, still extensively used in the colouring of peas and other green vegetables.

'The most commonly used colouring matter for dairy produce is annatto. This, and certain other yellow colouring matters of vegetable origin (turmeric, saffron, etc.) have generally been considered harmless in the quantities employed, but they are gradually being superseded by coal-tar yellows, the action of which upon the human system is not fully known.

'The colours to be obtained from coal-tar are practically unlimited in variety, and their tinctorial power is so great that very small quantities suffice to produce the required tint. They are consequently coming into increasing favour to replace the red, yellow, orange, green, blue and violet colours required for jams, temperance drinks, sweets and confectionery. A mixture of an azo-red and a brown allied to Bismark brown is used for imitating the smoke colour of hams.'

The report continues as follows:—

'Convinced as we are of the very general and increasing use of chemical preservatives by traders in the more perishable articles of food, we desire now to focus the evidence which has been placed before the committee, as to whether such preservatives may be expected to be attended with any risk to the public health.

'The evidence given before the committee bearing on this question, may be classified as that of:

A. The public analyst.
B. The medical officer of health.
C. The physician and surgeon.
D. The physiologist and pharmacologist.

A.—THE EVIDENCE OF THE PUBLIC ANALYST.

1. Prosecutions have exercised an inhibiting effect upon the use of preservatives.

2. Maximum amounts found must be regarded as exceptional and unnecessary: yet there is no guarantee that such excessive amounts may not continue to be used.

3. With regard to the precision with which limits could be determined, there was some difference of opinion; and as regards formalin, the evidence was unanimous that the estimation of such minute quantities as may be present in foods, is attended with great difficulty.

4. As to colouring matters the general testimony was to the effect that the nature and amounts of the substances in general use at the present time is such that but little danger is likely to accrue to the public health therefrom.

B.—THE EVIDENCE OF THE MEDICAL OFFICER OF HEALTH.

1. The medical officers of health were practically unanimous in their opinion that all preservatives should be prohibited in milk.

2. They saw danger in the unknown administration of drugs in morbid conditions of the body : and pointed out that such drugs are used at times, in amounts far in excess of those sanctioned by the B. P.

3. When more attention is paid by medical men to the use of preservatives, obscure conditions such as indigestion, malaise, faintness, &c., which at present receive no adequate explanation, may be made clear.

C.—THE EVIDENCE OF THE PHYSICIAN AND SURGEON.

1. Was not very conclusive, and it is evident that the question of food preservatives had not, at the time of inquiry, received special consideration by the medical profession.

2. Dr. Anderson had found that daily doses of 10 to 20 grains of boracic acid is generally followed by dyspepsia "sufficiently pronounced to make life miserable while it lasts, and at times it causes distinct gastritis, with repeated vomiting."

Sir Lauder Brunton considered that boracic acid was capable of exercising an injurious effect upon pregnant women.

3. On the other hand, an assistant physician at the London hospital described extended experiments as to the effects of borax and boracic acid upon himself, which resulted in "no sort of stomach irritation or intestinal irritation or trouble, or anything of that sort at all."

The consulting surgeon to Westminster hospital had administered borax to hundreds of patients in doses of 10 grains, 3 times a day, and up to 40 grains a day, and never found any evil or unpleasant effects, except in those patients who having kidney disease could not void the drug readily.

3. In so far, however, as expression of opinion went, the profession was almost unanimous in its condemnation of the present unrestricted use of preservatives. The medical profession was clearly impressed with the importance of at least intimating by a system of labelling, the nature, and when practicable, the amount of the preservative used. In the opinion of Sir Lauder Brunton and other witnesses, it is a serious matter that a medical man should prescribe a daily dose of any drug to a patient who may, unknown to himself and the physician, be consuming an indefinite quantity of the same drug in his food. He also pointed out that by the indiscriminate employment of drugs there was a possible danger that the action of certain drugs might be, if not entirely nullified, at least reduced in effect.

4. There was, however, another aspect of the question to which certain witnesses referred. They were of opinion that there are certain conditions of the human economy in which the administration of drugs, such as boracic acid and salicylic acid, are held to be contra-indicated. Among such conditions, specific reference was made to inflammatory states of the digestive tract, and of the reproductive organs.

D—Evidence of the Physiologist and the Pharmacologist.

1. All these witnesses strongly deprecated the unregulated use of preservatives, at least those at present known, and of any colouring matter having a possible deleterious effect upon the human system : and were generally agreed that formic aldehyde was a dangerous substance, even in very dilute solution.

2 An opinion inimical to the use of preservatives was also held by some of these witnesses on the ground that these substances were added to food for the purpose of destroying or preventing the development therein of living organisms, and hence that these same substances when introduced into the highly organized animal, could not behave indifferently to living matter, but must also tend to exert upon it some influence. Especially, they maintained, was this the case since the secretion of the digestive juices was dependent upon the activity of cells not differing sufficiently from microorganisms to render it probable that substances affecting deleteriously the one would be indifferent to the other.

3. Other objections offered by the physiologists applied especially to one preservative, viz., formalin, and were based upon the fact that this substance actually enters into combination with the proteid constituents of the food, the compound formed being less digestible than the original substance, thereby entailing a nutritive loss to the consumer.

4. Other witnesses testified to the value of chemical preservatives in protecting consumers from the evils of tainted or decomposing food. One witness said that in his opinion the use of preservatives, even in milk, under certain conditions, was in the public interest.

5. Dr. Attfield found, from experiments upon himself, that pharmacopœial doses of boric acid taken with his meals, had no appreciable action upon the digestion of his food. He found also that salicylic acid did not interfere with digestion.

6. Experiments on digestion in glass vessels were concerned with formic aldehyde, borax and boracic acid. Speaking generally, the results of these experiments may be regarded as showing that each of these substances had a retarding effect upon certain digestions; this amounting in the case of strong solutions of formaldehyde, to marked inhibition.

7. Experiments on animals (kittens) gave contradictory results.

8. The evidence was contradictory as to the harmfulness of copper 'greening' in peas and other vegetables.

The general conclusions of the committee are contained in the paragraphs numbered 103 to 135 of the Report to Parliament, and are exceedingly interesting and important.

Upon these conclusions are based the following recommendations:—

Recommendations.

(*a.*) That the use of formaldelhyde or formalin, or preparations thereof, in foods or drinks, be absolutely prohibited, and that salicylic acid be not used in a greater proportion than 1 grain per pint in liquid food, and one grain per pound in solid food. Its presence in all cases to be declared.

(*b.*) That the use of any preservative or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Food and Drugs Acts.

(*c.*) That the only preservative which it shall be lawful to use in cream be boric acid, or mixtures of boric acid and borax, and in amount not exceeding 0·25 per cent expressed as boric acid. The amount of such preservative to be notified by a label upon the vessel.

(*d.*) That the only preservative permitted to be used in butter and margarine be boric acid or mixtures of boric acid and borax, to be used in proportions not exceeding 0·5 per cent, expressed as boric acid.

(*e.*) That in the case of all dietetic preparations intended for the use of invalids or infants, chemical preservatives of all kinds be prohibited.

(*f.*) That the use of copper salts in the so-called 'greening' of preserved fruits be prohibited.

(*g.*) That means be provided either by the establishment of a separate court of reference or by the imposition of more direct obligation on the Local Government Board

to exercise supervision over the use of preservatives and colouring matter in foods, and to prepare schedules of such as may be considered inimical to the public health.

Dr. TUNNICLIFFE, while agreeing on all other points, took exception to the prohibition of the use of copper in colouring vegetables, holding that in a proportion not exceeding half a grain of metallic copper per pound the presence of copper is quite harmless.

The evidence heard before this committee was concluded May 14, 1900, and it may be safely regarded as a full statement of the case to that date.

In the abstracts which follow I have sought to give an account of work done upon this subject since the date mentioned; and, in a few cases, to do this for important work which was not brought to the notice of the committee.

LEO. GOLDSMITH (thesis for B. Sc. degree. Abstract by Prof. Mayberry in Jour. Am. Ch. Soc,, 1897, p. 889) made several series of experiments on the digestion of blood fibrin in presence of alum, boric acid and formalin. The results are summarized as follows:—'While all the substances tested show some influence on the digestive action of pepsin only alum exhibits a marked effect.'

E. LABORDE (Jour. farm. Chim, 1899, 484. Through the Analyst, 1900, 154).

Small quantities of isobutyl alcohol, glycerol and malic acid favoured peptic digestion; also methyl alcohol in very slight degree; ethyl and propyl alcohols, lactic and tartaric acids and mannitol and glucose on the other hand retarded peptic digestion.

With trypsin (pancreatic digestion) methyl and isobutyl alcohols, glycerol and glucose accelerated, while ethyl and propyl alcohols, lactic, malic and tartaric acids and mannitol, retarded the process.

OTTO and CHARLES W. HEHNER (Analyst, 1902, 173) give the results of experiments which show that 'salivary action is prevented by a solution containing 0·04 per cent of sodium fluoride, or its equivalent in ammonium fluoride, and that as little as 0·02 per cent solutions of fluoride greatly interfere with peptic digestion.'

WALDEMAR KOCH (Am. Jour. Physiol., 325). The action of formaldehyde does not depend on active oxygen. Yeast made to grow anœrobically is killed by it in 0·05 per cent solutions, but in 0·005 per cent solutions is unaffected. In cases of tryptic digestion, where the presence of formaldehyde has been observed to interfere with digestion, the reason may be discovered in the fact that the formaldehyde acts upon the proteids and renders them indigestible.

H. LEFFMANN (Journ. Franklin Institute, 1899–97. Through 'The Analyst,' 1899, 102).

From the results of a large number of experiments on the artificial digestion of arrowroot starch, the author concludes that 'beta-naphthol is injurious to malt-diastase, but does not seriously affect the starch-converting capacity of taka-diastase or pancreatic extract. Boric acid, borax and boroglyceride interfere but little with either starch or proteid digestion. Salicylic acid interferes with the action of most of the enzymes, especially those that convert starch, but does not seriously affect proteid digestion. Sodium benzoate has no appreciably injurious influence on any of the enzymes. Sodium fluoride interferes but little with the digestion of starch, but sodium silico-fluoride has a considerable influence on pancreatic extract.

In his opinion, if the use of any preservative is to be permitted in food, boric acid and sodium benzoate are the least objectionable since they appear to have less tendency to disturb the digestive functions than the other preservatives commonly employed.

F. BERLIOZ (Chem. Zeit. 1900, 416)—The author's experiments confirm the statement of Nencki, that saccharin, at least in small amounts, does not interfere with gastric or pancreatic digestion.

LEBBIN and KALLMAN (Zeits. offentb. Chem. 1901, 324)—From numerous experiments carried out on animals and on human beings, the authors have come to the conclusion that our present notions as to the toxicity of normal sulphites are wholly erroneous. With acid sulphites, however, the action is quite different, for most of them are as corrosive as free acids.

The following medical testimony regarding the use of milk containing preservatives, was given in a case brought before the English courts, and is reported from the British Food Journal, 1901, p. 110.

Dr. CHARLES JACKSON, medical officer of health for Fulham, 'had seen cases where children using milk containing boracic acid, exhibited serious digestive disturbances.'

Dr. L. B. DIPLOCK said, 'four years ago he had attended a large number of children suffering from marasmus, and on testing the milk with which they were fed, he found in each case that it contained boracic acid. Upon the infants being fed on pure milk direct from the cow, they recovered without the aid of any medicine, yet before he discovered the cause of the symptoms several of the infants died.'

The following notes on the use of boric acid and its salts are taken from the Zeit. für Untersuch. der Nahr. und Genussmittel, 1902, 678-682 (through 'Analyst,' 1902, 271).

E. ROST 'As the antiseptic action of boric acid is small, comparatively large quantities are necessary to preserve articles of food, and it is quite possible for a person to take as much as 3 grammes daily in his ordinary food. Meats, sausages, milk, butter, margarine, white and yolk of egg, fish, caviare, shellfish, &c., are frequently preserved by the action of boric acid. The author found 3·87 per cent, in dry salt meat and 2·8 per cent. in shrimps. Boron compounds are stated to have no specific action on the enzymes of the stomach and intestines, except as regards their acid or alkaline properties. Borax retards to a small extent the coagulation of milk by rennet; the addition of borax to milk especially when the latter is intended for infant's food, is therefore injurious. Large doses were found to cause local irritation and inflammation in dogs, cats and rabbits, and also affected the action of the bowels. In two experiments on men it was found that doses of 1, 2 and 3 grammes of boric acid retarded the assimilation of albuminoids, the nitrogen contents of their urine being determined hourly before and after taking the boric acid. By taking the temperature of various dogs fed on borated meat, it was demonstrated that assimilation of the food was delayed. Experiments on other dogs showed that only large doses caused a loss of corpuscular albuminoids. It may be here mentioned that no essential difference was noticed between the action of boric acid and borax. A striking loss of weight in the animals was noticed. As this was not due to destruction of albumen or loss of water, it must be put down to oxidation of fat. Apparent increase in the digestion of albumen, shown when very large doses of borax were given, was due to the 'salt' action of the borax, similar results being exhibited by large doses of common salt and potassium nitrate. A large comsumption of water prevented these effects.

'Assimilation experiments in the presence of boric acid were carried out on four assistants. During a preliminary period of 5 to 17 days the men were brought into a state of 'nitrogen equilibrium' followed by administration of boric acid (3 grammes per diem) for 12 days. Two of the men then, for a time received no boric acid, and afterwards underwent a second treatment. Finally, some days were devoted to studying the after symptoms of the experiments. Two of the men showed a loss of weight due to loss of fat. The final observations also showed less secretion of urine and absorption of food materials. The two other assistants also showed a loss of weight. These two latter were also chosen for Rubner's experiments (see below) in which the amounts of expired carbon dioxide and water were determined. One of them diminished so suddenly in weight after taking 3 grammes of boric acid daily, that the experiment had to be discontinued. The weight of the other also decreased, but increased when the boric acid was discontinued, and fell again when the latter was readministered. It was not demonstrated by the above experiments, that boric acid affected the appetite. No influence upon health and appetite were noticeable. Boric acid was not found by the author to influence the temperature, blood pressure or kidneys. As the elimination of boric acid by the urine takes from 8 to 14 days, its action is probably cumulative. The author comes to the conclusion that the use of boron compounds in food should be forbidden.'

RUBNER.—According to the author, who comes to the conclusion after numerous experiments, boric acid has an important latent action on the digestive process. Not only the digestive organs themselves, but the whole alimentation is affected. The change produced, which may amount to a loss of 22 per cent. of energy and 30 per cent. of the utilization of nitrogen free food, is a very important fact, and undoubtedly means injury to health, as the amount of fat in the body may be of the greatest importance, and the reduction of the fat must be followed by a rapid fall in albuminoids. Serious results may follow in infant feeding, to invalids, old people or convalescents by borated foods.

R. O. NEUMANN.—The experiments carried out by the writer on himself consisted of a preliminary period of 4 days, during which various observations were taken; then 10 days with daily doses of 3 grammes of borax, followed by 4 days without borax; and concluding with daily doses of 5 grammes of borax for 3 days. During the first period nitrogen equilibrium existed; the secretion of nitrogen decreased during the first borax treatment, also in the intermediate 4 days, but was not further diminished by the larger doses of borax. His weight fell 1,200 grammes in seven days of the borax period. The flow of urine was somewhat increased, and boric acid could be detected for 18 days after the last dose of borax had been taken.

A. HEFFTER made four series of experiments on himself, alternately fasting for 18 to 20 hours, and then feeding on milk and eggs for 48 hours. In two of the series he used food without borax; in the other two he used 1 and 4 grammes borax daily. The boric acid was found to increase the solids and nitrogen in the excreta, probably due to the diminished absorption of albuminoids as a result of the injurious effect of the boric acid on the mucous membrane of the intestines. The conclusion is that boric acid is not without objection when used as a preservative.

G. SONTAG found by experiment that 3-gramme doses of boric acid required 5, 8 and 9 days, respectively, for elimination by the urine, in the cases of three healthy individuals.

A. WEITZEL.—Experiments on the coagulation of milk by rennet, in presence of various substances, as follows:—Group (1) Alkaline: Borax, sodium hydroxide, sodium carbonate and sodium bi-carbonate. (2) Salts capable of precipitating lime: Sodium oxalate, sodium fluoride and sodium oleate. (3) Other salts having an alkaline reaction: Sodium sulphite, salicylate, benzoate, propionate, acetate and formate. (4) Neutral salts: Sodium chloride, lithium chloride, sodium nitrate, perchlorate, tartrate, sulphate, ammonium sulphate and magnesium sulphate. (5) Acid salts: Sodium hydrogen tartrate, sodium hydrogen sulphate and sodium persulphate. (6) Acids: Boric, carbon dioxide, oxalic, benzoic, salicylic, protocatechuic and gallic. (7) Formaldehyde, saccharin and cane sugar.

The following results were obtained:—

(1) Borax retarded the coagulation when present in only small quantities (0·01 to 0·04 per cent), and the amounts usually employed (1 gramme per litre of milk) stopped the action of the rennet altogether. All other alkaline salts acted similarly.

(2) Coagulation was checked by those salts which precipitated the lime compounds. When the reaction became alkaline, the influence of alkalinity also showed itself.

(3) The neutral salts generally had a retarding action. Some (sodium and lithium chloride), principally in concentrated solution, more feebly when present in small quantities. Magnesium sulphate, in both concentrated and dilute solution, had considerable influence.

(4) Small quantities of the acids aided the coagulation. After carbon dioxide, boric acid had the most feeble action. The acid salts acted in the same manner as the acids.

(5) The action of formaldehyde was so powerful that it must be considered as a direct poison to the rennet enzyme. Saccharin in small quantity had little influence, but stronger solutions greatly hindered the coagulation. Sugar, up to 20 per cent of the weight of the milk, had no action.

E. POLENSKE showed experimentally that fresh and smoked hams, when packed in borax, dry, for periods of three and four weeks, absorbed into the interior of the ham quantities of borax varying from 0·076 to 4·05 per cent.

L. Portes and A. Desnoulières, (Ann. Chim. Anal. Appl. 401) "have found out, by the examination of fresh strawberries, that salicylic acid, probably as the methyl ester, is a normal constituent of this fruit. The amonnt in the fresh berries is about 1 mgr. per kilog. (i.e. about 1 part per million or 0.0001 per cent.)"

E. O. V. Lippman (Chem. Zeit. 1902; 465) found a deposit in a vacunm pan, which had been used for concentrating lemon juice. On analysis this gave about 0.5 per cent of boric acid. Various commercial samples of lemon juice were then examined, as well as lemons and oranges, and in nearly every instance strong boric acid reactions were obtained. In the lemons, boric acid was detected both in the juice and in the rind.

H. A. Weber (Amer. Chem. Journal, 1896, 1092) made a series of experiments to determine the influence of coal tar colouring matter on the digestion (by pepsin and pancreatin) of blood fibrin. He reaches the following conclusions:—

Oroline yellow ("acid yellow" or "fast yellow" of the trade) has a marked and injurious effect on peptic digestion.

Saffoline (acridine red) slightly retards peptic digestion, but the author considers its effects to be practically *nil*.

Magenta—does not appear to interfere with peptic digestion.

Oroline yellow—does not retard pancreatic digestion.

Saffoline—has a strong retarding effect on pancreatic digestion.

Magenta—acts like saffoline towards pancreatic digestion.

Methyl Orange—acts like saffoline and magenta in retarding pancreatic digestion.

From the examination of these four colours, it appears that while none interfere with both peptic and pancreatic digestion, all interfere with one or the other, and are therefore very undesirable in food or drink.

Frentzel. (Zeit. für. Untersuch. der. Nahr. und Genussmittel, 1901; 968.)—In this paper are given the results of a considerable number of experiments, consisting in feeding rabbits, dogs and human beings with food mixed with the colours "mandarin" (obtained by diazotizing sulphanilic acid and B. naphthol) and "metanil yellow" (prepared by diazotizing meta-benzene-sulphonic acid and diphenylamine). The conclusions arrived at are that the colours can scarcely be considered poisonous in the small quantities in which they are used in foods. Long continued, large doses, however give rise to some injurious effects: but this quantity is never, in the natural course of things, even approximately reached.

Chlopin. (Zeit. für Untersuch. der Nahr. und Genussmittel, 1902; 241) finds that "metanil yellow" is harmless, even when given in daily doses of 2 to 3 grammes to dogs, and 0·2 gramme to human beings. On the other hand he does not agree with the statement of Frentzel that "mandarin" is innocuous in moderate quantities. Given in daily doses of 2 grammes to a dog it caused uneasiness, vomiting and diarrhoea. The author himself took 0·2 gramme, and the symptoms were so alarming (dizziness, headache, &c.) that the substance had to be removed from the system by means of a purgative.

The following concise summary of Food Laws, as regards preservatives, is taken from a bulletin issued by the United States Department of Agriculture, through the *Jour. Soc. Chem. Industry*, 1901, p. 774:—

'Prohibition of the use of chemical preservatives and aniline dye stuffs as colouring agents for liquors is almost universal, while the employment of all foreign colouring matter is often prohibited. The use of chemical preservatives and foreign colouring matter with beer is usually prohibited. The sale of foods containing saccharin, sucrol, and similar preparations is prohibited in Belgium, France, Germany, Italy and Roumania. The importation of saccharin, except for medicinal use and under prescribed conditions, is prohibited by Belgium and Greece. All countries permit the dyeing of confections and similar articles which are themselves colourless, but are customarily coloured artificially. Belgium permits mustard to be coloured artificially when properly labelled. Salicylic acid and boric acid have been used so much more commonly than

other preservatives, that legislation is usually directed against them, whilst local bodies often extend the prohibitions to benzoic acid and other substances as they come into use.

'The sale of foods containing preservatives is prohibited in Austria, France, Hungary and Roumania, and that of beverages containing preservatives in Belgium, Germany and Switzerland. The addition of salicylic acid to food is prohibited in France. Holland does not not permit the sale of beer containing salicylic acid, and Spain forbids its addition to wine. Italy permits the addition of 0·2 per cent. of boric acid to butter, but forbids the use of other preservatives.'

While I cannot say that I have, in the preceding pages, given a resumé of all the important work that has been done upon preservatives and colouring matters, I believo that I have referred to and summarized all the important researches which have ceme under my notice. It will, I think, be conceded by anyone who reads the subject carefully, that the balance of evidence is decidedly against the use of any preservative in food. At the same time it must be granted that there are degrees of danger to health among the chemical substances which find favour as preservatives among manufacturers and vendors of food; and it may be that, in certain cases, less harm may result from the preservative than would result from deterioration of the food-stuff, were this kept for a length of time without an antiseptic. In order to decide the question as to whether, in certain cases, such as long voyages, travelling in out-of-the-way regions, supplying stores to soldiers on the march, mining camps, &c., as well as in the distribution of food-stuffs to the great centres of population, far removed from the places where such foods are produced, it might not be preferable to employ chemical preservatives rather than consume food which had suffered natural decomposition, or pay the high prices necessitated by quick transit, or such costly methods as cold storage, hermetical sealing, &c., it is evident that experiment must determine the extent of the injury to health which results from the use of food preserved from decomposition by antiseptic chemicals.

Experiments having this object in view, were recently made in the Imperial Health Office at Berlin; but the most interesting series of such experimental work is only now being inaugurated at Washington, D.C., under the management of the Bureau of Chemistry, of which Dr. H. W. Wiley is chief. I have just received the following communication regarding this matter from my friend Dr. W. D. Bigelow, chief of the Food Laboratory at Washington: 'The experiment is being undertaken very seriously, and on a somewhat extensive scale. In fact we consider it the most important inquiry we shall have on hand this year. About a dozen men, almost all from the Department of Agriculture, have volunteered, and will be divided into two equal lots, one of which will eat preserved food, while the other will receive only food that is known to be pure. The conditions will be controlled as carefully as possible, and the presence of nitrogen, phosphoric acid, and energy expressed as heat of combustion, will be determined. The preservative used will be determined in the food, as well as in the excrement and urine, and careful observations will be made daily regarding the physical conditions of the men. A "clinical" sheet will be kept for each man. The work will be very similar to that recently conducted by the Imperial Health Office at Berlin, but will be more extensive and will also differ from it in the fact that we shall employ largely young men of scientific training instead of labourers. We are just entering upon this work now. The first table will be started the beginning of next week, and the analytical work will begin early in December.'

The above extract is from a private letter, dated 19th instant; so that when this memorandum is before the public, the experiment will be well in progress. I am sure that everyone interested in the subject with which I have been dealing will await with eagerness the results of Dr. Wiley's investigation. And in the meantime, until we are made aware of the amount of injury which may ensue from the use of 'preserved' food, the part of wisdom will be to eschew, as far as possible, every article which we suspect to be so treated.

As to artificial colouring matters, we have seen that the British Food Commission did not find itself justified in making a decided pronouncement. These articles are employed in such minute amounts that it is naturally very difficult to obtain certain information as to their specific physiological effects, when used along with food. The experiments of Weber, Frentzel and Chlopin, show that the most commonly occurring colouring matters interfere with digestion, but in all their experiments the quantities employed were very largely in excess of any that occur in food stuffs. I find that the red colour given to ketchup by coal-tar dyes is so different from the natural colour of a home-made ketchup, that I am surprised at the saleability of the artificial article. The demand for a deep yellow colour in cheese is another example of false taste on the part of the public. It seems to me rather surprising that the highly coloured articles of food should not, by that very fact, warn purchasers against them.

A. McGILL.

RESULTS of examining 27 samples

Date of Collection.	Description of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher, as given by Vendor.	Serial Number.	Departmental Number.
1902.					
July 31	Lime Juice, bottled by vendor.	A. W. Puddin, Charlottetown, P.E.I.	Simpson Bros., Halifax, N.S..	1	4310
" 31	" " ..	Stewart & Gates, Charlottetown, P.E.I.	" "	2	4315
" 30	Lime Juice.....	A. Hendry, Winnipeg, Man.	Blackwood Bros., Winnipeg, Man.	3	17421
" 31	"	The A. McDonald Co.....	The Bole Drug Co., Winnipeg, Man.	4	17422
" 23	" bottled by furnishers.....	E. C. Brown, St. John, N.B.	Simpson Bros., Halifax, N.S..	5	17846
" 25	West India Lime Juice, from bulk.	W. C. R. Allan.	Hattie & Mylius, Halifax, N.S.	6	17848
Aug. 6	Lime Juice, Sovereign Brand.	F. W. Davison, Wolfeville, N.S.	Simpson Bros., Halifax, N.S..	7	20228
" 7	Lime Juice, Sterling Brand.	Dimock Bros., Windsor, N.S.	Hattie & Mylius, Halifax, N.S.	8	20229
July 25	Lime Juice..	W. McMillan, Brockville, Ont.	Turner & Co., Toronto.....	9	21234
" 25	"	J. A. Johnston, Brockville, Ont.	F. A. Lytle & Co., Toronto....	10	21236
" 25	"	Peoples' Supply Co., Toronto.	Crown Manufacturing Co., Toronto.	11	21238
" 25	"	Swan Bros., Toronto	Simpson Bros. & Co., Halifax, N.S.	12	21239
" 28	"	Geo. Wagg, Vancouver, B.C.	Kelly, Douglas & Co., Vancouver, B.C.	13	21677
" 30	"	F. Filion, Vancouver, B.C.	West India Lime Juice Co., St. Thomas, W. I.	14	21682
" 23	Lime Juice made by Bottger & Co., England	J. W. Irwin, Clinton, Ont.	Rose & Laflamme, Montreal...	17	22038
" 23	Crown Lime Juice.....	John S. Roberts, Seaforth, Ont.	Lyman Bros. & Co., Toronto ..	18	22042
" 22	Lime Juice	J. C. Downs & Co., Stanstead, P.Q.	Brayley & Sons, Montreal.....	19	23334
" 24	"	Pagnuelo Freres, St. Hyacinthe, P.Q.	Kenneth Campbell Co., Montreal.	20	23338
	Lime Juice, Crown Brand	Obtained in Toronto	... ...	21	Spec'l
	" Montserrat...	Purchased in Ottawa	.....	22	" .
	" Standard Brand.	"	... .	23	" .
	Lime Juice, Dominion Brand.	" ...	....	24	" .
	Lime Juice, West Indian Brand.	" ...	....	25	" .
	Natural Lime Juice, as imported.	....		26	No. 1.
	" "	.. ..		27	" 2
	" "	....		28	" 3
	" "	.. ..	Clarified in Halifax..	29	" 4

of Lime Juice, by A. McGill.

Specific Gravity.	Dissolved Solids. Dry at 100 c.	Acidity per 100 cc. In terms of normal soda.	Acidity as Citric Acid.	Organic Acids, in terms of normal soda.	Organic Acids, calculated as Citric Acid.	Combined org. acids as Citric.	Optical rotation in 2 dm. tube.	Phosphoric Acid as P_2O_5 per 100 cc.	Alcohol, as proof spirit.	Preservatives.	Remarks.
p. c.	p. c.	c. c.	p. c.	c. c.	p. c.	p. c.	S.V. Scale.	p. c.	p. c.		
1·0289	5·36	84·0	5·88	90·8	6·36	0·48	0·0	None	None.	None	
1·0386	8·86	108·4	7·59	116·0	8·12	0·53	0·0	"	3·03	Salicylic acid.	
1·0237	5·59	74·4	..	77·6	..	....	+1·2°	"	1·74	"	..
1·0198	4·46	63·6	4·45	66·0	4·62	0·17	0·0	"	0·23	None	... Contains 0·029 SO .
1·0262	7·70	79·6	5·57	82·4	5·77	0·20	0·0	"	0·70	"	..
1·0335	8·52	116·0	8·12	122·4	8·57	0·45	0·0	"	2·09	Salicylic acid.	
1·0323	7·48	102·5	7·18	107·2	7·50	0·32	0·0	"	1·74	None	...
1·0384	8·47	106·9	7·48	114·8	8·04	0·56	0·0	"	0·12	"	..
1·0330	6·43	78·0	.....	44·8	.....	..	0·0	1·28	1·51	Salicylic acid.	Contains 0·120 % HCl, and tartaric acid.
1·0222	4·91	66·0	..	64·8	.....		−2·8	0·14	1·04	"	.. Contains tartaric acid.
1·0316	5·70	68·4	.. ..	32·8	....	....	1·4	1·40	0·70	"	Contains 0·141 % HCl, contains tartaric acid and is coloured by a green dye.
1·0379	8·29	113·2	7·92	119·6	8·37	0·45	0·0	None	0·35	None	..
1·0243	4·69	76·4	.	78·8	.....	. . .	0·0	Trace.	0·58	"	..
1·0353	7·97	105·3	7·37	110·0	7·70	0·33	0·0	"	0·23	"	.
1·2421	51·74	44·0	3·08	42·0	2·94	None.	60·0	None	0·70	Salicylic acid.	Contains much sugar.
1·0352	7·64	114·8	8·04	120·4	8·43	0·39	0·0	"	0·58	None	...
1·0417	9·68	118·8	8·32	124·8	8·74	0·42	0·0	"	0·35	"	..
1·0292	8·08	101·6	7·11	108·0	7·56	0·45	0·0	"	3·99	"	.
1·0328	6·27	70·3	. .	...	...	.	−1·0°	1·264	1·16	.....	Contains tartaric acid.
1·0318	7·94	98·5	6·90	102·5	7·18	0·28	0·0	None.	None.		
....	2·14	28·4	1·99	29·2	2·04	0·05	0·0	"	.		
.. ..	8·22	110·8	7·76	115·2	8·06	0·30	0·0	"	.		
.....	8·24	113·6	7·95	116·0	8·12	0·17	0·0	"	.		
1·0398	.. .	116·0	8·12	121·6	8·51	0·39	0 0	"			
1·0393	....	110·0	7·70	116·8	8·17	0·47	0·0	"			
1·0363	.....	105·0	7·35	108·4	7·59	0·24	0·0	"	.		
1·0370	.....	108·0	7·56	110·0	7·70	0·14	0·0	"			

RESULTS of Examining 26 samples of

Date of Collection.	Name and Address of Vendor.	Name of Article as sold and Name of Furnisher when given by vendor.	Serial Number.	Departmental Number.	Name of Brand.
1902.					
July 31	J. D. McLeod, Charlottetown, P.E.I.	Tomato Catsup	1	4313	Mrs. Jones'.....
" 31	" "	Tomato Ketchup	2	4314	Heinz.....
" 29	J. Mullen, Winnipeg, Man.....	Catsup	3	17419	Ice Castle .....
" 29	W. W. Stone "	Chutney Ketchup..... ..	4	17420	Chutney Ketchup...
" 29	C. D. Phelps, St. John, N.B.....	Tomato Ketchup	5	17852	Beefsteak.....
" 29	P. Nase & Son, St. John, N.B...	Tomato Ketchup. Deerborn & Co., St. John, N.B.	6	17853	Bar Harbour.....
Aug. 6	DeWolfe & Lamont, Kentville, N.S.	Tomato Ketchup	7	20227	Butler's ... .
" 7	J. Scott & Co., Halifax, N.S.....	Mushroom Catsup...	8	20232	Mushroom .....
July 24	J. Downeys, Belleville, Ont.....	Tomato Catsup	9	21229	Queen.....
" 24	Hovey & Son, Coburg	"	10	21231	Monarch . .....
Aug. 5	A. Paquette, Montreal	"	11	21241	English Spiced.....
" 5	Richard et Frère, Montreal.....	"	12	21242	Tomato Ketchup ...
July 28	Geo. Wagg, Vancouver, B.C.....	Ketchup. Paupe Vinegar Works, California	13	21676	Gold Medal,.....
" 28	H. Albert "	Ketchup	14	21678	Pure Catsup.....
			15	21709	Pure Gold.....
			16	21710	....
July 22	Sturday & Co., Goderich, Ont....	Tomato Catsup. Pure Gold Mfg. Co., Toronto.	17	22035	Club ....
" 22	J. W. Irwin, Clinton, Ont.....	Catsup	18	22037	Anglo-Saxon Eclipse
" 21	A. L. Brown & Son, Lennoxville, Que.	Catsup. Pure Gold Mfg. Co., Toronto.	19	23329	Pure Gold.....
" 21	D. P. Matheson & Co., Lake Megantic, Que.	Ketchup. Tip Top Ketchup Co., Cincinnati, O.	20	23332	Butler's .....
			21	Special.	Pure Gold... .....
			22	"	Homemade.....
			23	"	" .....
			24	"	Stirling.....
			25	"	Snider ....
			26	"	Club ....

SESSIONAL PAPER No. 14

Ketchup or Catsup by A. McGill.

Manufacturer, as given on the label.	Coal Tar Dye Stuff.	Dry Solids, per cent.	Preservative.			Acidity per 100 cc.		Remarks.
			Sulphurous Acid or Sulphites.	Salicylic Acid.	Benzoic Acid.	Stated in cc. per normal acid.	Calculated to Acetic Antrydride.	
Williams Bros. & Charbonneau, Detroit.	Present.	24·4	Doubtful.	None.	Present.	17·2	0·877	
H. J. Heinz Co., Pittsburg.	"	19·2	None.	"	"	18·6	0·918	
J. W. Windsor, Montreal and St. Eustache.	"	12·3	"	Present.	None.	15·6	0·796	
Blackwood Bros., Winnipeg	None.	18·3	Trace.	"	"	12·8	2·183	
J. Campbell Preserve Co., Camden, N.J.	Present.	21·3	Present.	None.	Present.	20·0	1·020	
.....	"	12·7	None.	"	"	11·4	0·581	
Tip-top Ketchup Co., Cincinnati.	Doubtful.	19·5	Trace.	"	Trace.	14·4	0·734	
Crosse & Blackwell	None.	17·2	None.	"	None.	10·8	0·551	
Belleville Canning Co ...	Present.	19·3	Present.	"	Present.	21·4	1·091	
J. M. Lowes Co., Toronto..	None.	19·8	None.	Present.	None.	16·2	0·826	
Montreal Canning and Preserving Co.	Present.	8·7	Traces.	None.	Present.	20·8	1·081	
H. Bourque, Montreal. ...	"	7·6	None.	"	None.	23·0	1·380	
.....	"	9·1	"	Present.	"	12·0	0·612	
VanCamp Packing Co., Indianapolis.	"	23·5	Traces.	"	"	12·0	0·612	
.....	"	25·3	Present.	"	.....	.....	.....	
Garden City Canning Co., St. Catharines, Ont.	None.	18·0	Trace.	None.	.....	.....	.....	
.....	Present.	25·7	Present.	"	Present.	23·6	1·204	
P. M. Card, Guelph...	Doubtful.	35·4	"	Present.	None.	33·6	1·714	
.....	Present.	24·0	"	"	"	13·6	0·694	
See No. 7	Trace.	18·2	"	None.	"	16·2	0·826	
.....	Present.	29·7	Trace.	"	Present.	28·0	1·428	
Mrs. G., Ottawa.....	None.		None.	"	None.	.....	.....	Samples 22 and 23 were furnished by friends for purposes of studying reactions.
V.— - "	"	30·2	"	"	"	.....	.....	
T. A. Lytle & Co., Toronto.	Present.	18·3	Present.	"	Doubtful.	21.6	1·102	
Snider Preserve Co., Cincinnati, O.	"	19·3	None.	"	Present.	11·2	0·571	
.....	"	15·5	Present.	"	Doubtful.	22·2	1·132	

APPENDIX C.

BULLETIN No. 84,—CEREAL BREAKFAST FOODS.

OTTAWA, December 17, 1902.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR,—I beg to transmit herewith a report by Mr. A. McGill, M.A., assistant to the chief analyst, on Cereal Breakfast Foods, together with a tabulated statement of the analytical results obtained by him in this laboratory, with the assistance of Miss E. Davidson, Miss S. E. Wright, Mr. Alphonse Lemoine and Mr. J. G. A. Valin. The statement also shows the nature and origin of the different samples examined.

I have the honour to be, sir,
Your obedient servant,

THOMAS MACFARLANE,
Chief Analyst.

LABORATORY OF THE INLAND REVENUE DEPARTMENT.

OTTAWA, December 10, 1902.

THOS. MACFARLANE, Esq., F.R.S.C.,
Chief Analyst Inland Revenue Department,

SIR,—I beg herewith to submit a report of my work on Breakfast Foods.

These samples, as you are aware, were not collected and examined because of any suspicion regarding their wholesomeness or genuineness, for they were believed to be as their analysis proves them to be, nutritious and palatable foods. In view, however, of the high prices at which they are sold, and of the extravagant claims put forth by their manufacturers as to their digestibility, nutrient power, &c., there exists a wide-spread demand for information as to what they really are, and how much of all the value claimed for them they really possess.

The use of oatmeal, cracked wheat, cornmeal, &c., as materials for porridge, goes back as far as history, but the use of so-called prepared foods, is a thing of very recent date. Most of these foods claim to be partly or wholly cooked, and in view of the practical indigestibility of uncooked starch, it is matter of high importance that the purchaser should know just how much of truth there is in the claim. The further inquiries as to relative richness in nitrogen, digestibility of the nitrogenous material, proportion of salts, &c., are scarcely of secondary importance, particularly in cases where the manufacturer promises a 'perfect food,' i.e., a food capable of satisfying every demand of the system.

Unfortunately our knowledge of the different forms in which nitrogen occurs in cereals is far from perfect; and the excellent work done in recent years by chemists in this field, has been achieved by methods of operation too involved and too time-consuming to render them available in the laboratory of the food-analyst. The points of

difference in quantity and quality which have been demonstrated, among others, by Osborne and Voorhees (*See* Journal Am. Chem. Society, 1893, and succeeding years) between the proteids of different cereals, have doubtless a very important relation to the values of these cereals for human food. But the differences in question are not available by any practicable methods of working, for the use of the analyst. It is even too much to say that our knowledge of the carbo-hydrates of cereals approaches completeness ; while the relative values of these materials in nutrition is still another aspect of the question, that must be dealt with by the physiological chemist.

Available methods for the proximate analysis of cereals, enable us to discriminate so far as indicated in the analytical tables furnished herewith. The work might even be carried somewhat further, since fairly well accredited methods for the estimation of pentosans, among the carbohydrates, and amidic bodies, among the azotized components, have been worked out. Pressure of work has, however compelled me to leave this task less complete than I should wish.

The earliest work on the examination of *Prepared Cereal Foods* which has come under my notice, is that of Slosson, published in Bull. 33 of the Wyoming Experiment Station in 1897. In addition to most of the usual determinations, Mr. Slosson has estimated *phosphorus*, and the following limit results for phosphorus and calorific values, are of interest :

	Phosphorus per cent.			Calories per Gram.		
	Max.	Min.	Mean.	Max.	Min.	Mean.
From 21 samples of prepared cereal food.	·447	·153	·321	4,756	3,660	4,326

The highest content in phosphorus, as well as the highest calorific value, are found in preparations of oatmeal, so that the popular preference for this cereal, seems to be warranted on scientific grounds.

In Part 9, of Bull. 13—U. S. Department of Agriculture, 1898, Dr. Wiley has published the results of analysis of 48 samples of Breakfast Foods. The following summary of his results has both interest and value (See pp. 1345—1349, op. cit.) :—

MEAN RESULTS ON CEREAL FOOD PRODUCTS.

From Bull. 13, part 9,—U. S. Dept., of Agriculture.

Class of Food.	Moisture.	Fat.	Ash.	Crude Fiber.	Total Nitrogen	Carbohydrates other than fiber.	Digestible Proteids.	Calories of Combustion.
Indian corn products (mean of 6 samples)	12·33	0·58	0·66	0·67	1·27	78·51	24·86	4,360
Wheat products (mean of 14 samples)	10·08	1·80	1·55	1·48	1·90	75·62	62·47	4,482
Oat products (mean of 7 samples).	7·66	7·46	1·79	1·20	2·45	67·61	51·09	4,671
Starch and tapioca (mean of 7 samples)	11·29	0·03	0·14	0·13	0·06	88·15	.....	4,160
Noodles, spaghetti and macaroni (mean of 9 samples)	9·66	0·42	0·78	0·56	1·92	77·12	80·53	4,342
Barley	10·92	0·89	0·86	0·67	1·20	80·35	39·20	4,365
Miscellaneous (4 samples)	6·41	1·05	1·06	0·99	2·05	78·68	52·04	4,460

Dr. Wiley has explained to me that the results entered in the column headed 'Digestibles Proteids,' were obtained by working with Wilson's modification of Stutzer's pepsin method—This is fully described in Jour. Soc. Chem. Industry, 1891, p. 118.

The calorific values given in the last column, were found by actual combustion. When, however, the proximate analysis of a cereal is given, the calorific value (in calories per gram) can be very closely ascertained by using the following factors:—

Pentoses, lactose, crystalized dextrose and fructose=3,750 calories per gram.
Sucrose, maltose and anhydrous lactose=3,950 calories per gram.
Starch and cellulose=4,200 calories per gram.
Proteids=5,900 calories per gram.
Fat (Ether Extract)=9,300 calories per gram. Bull. 13—part 9,—U. S. Dept., of Agriculture—pp. 1245—1249.

For the purpose of calculating the calorific value of these cereal foods, the numbers given in the accompanying analytical tables may be thus written :—(mean results are used.)

Malt Breakfast Food—

	Per cent.			
Moisture	9·99			
Fat	1·03	×	93 =	95·8
Ash	0·56			
Proteids	12·44	×	59 =	734·0
Fiber	1·05			
Dextrin	3·24	×	42 =	3,265·0
Starch (difference)	71·69			
	100·00			4,094·8 calories per gram.

The Calorific values in the following table are calculated after the manner shown.

Sample.	Moisture.	Fat.	Ash	Proteids — Nitrogen × 6·25.	Crude Fibre.	Dextrin	Starch — By difference.	Calories per gram.	Material Soluble in cold water.
	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
Malt breakfast food	9·99	1·03	0·56	12·44	1·05	3·24	71·69	4094·8	13·00
Force	11·92	1·27	2·75	11·56	2·60	14·48	55·42	3845·1	29·60
Malta vita	11·10	1·25	3·00	9·88	3·15	9·26	62·36	3840·3	30·88
Grape nuts	9·43	0·58	1·64	12·00	2·03	24·87	49·45	3968·9	49·50
Life chips	9·90	1·69	2·60	9·69	2·90	12·16	61·06	3925·9	19·30
Ralston breakfast food	13·02	1·54	0·78	12·50	1·68	2·62	67·86	3911·7	7·50
Rolled oats	11·21	7·21	1·68	12·69	3·14	3·58	60·49	4242·2	6·19
Oatmeal	10·84	6·91	1·14	13·00	4·28	....	63·83	4270·6	3·85
Peameal	10·40	1·33	2·62	27·56	1·36	.....	56·73	4132·7	17·75
Cornmeal common	13·12	5·21	1·42	10·25	3·50	.....	66·50	4029·2	6·30
" golden	14·90	2·01	0·58	8·94	1·18	.....	72·39	3804·3	2·90

One is often asked the question 'Which of all these breakfast foods is the best value from the point of view of nutrition?' While a categorical reply to such a question is not possible, the data contained in this table make a conditioned answer quite possible. Provided that the article is served up in such a way as to render it fully digestible, then from a consideration alone of the energy that can be derived from it, there is very little to choose between them.

The extremes in calorific value are found respectively in oatmeal (4270·6) and golden cornmeal (3804·3). The difference between these values is only 466·3 calories, or 11 per cent. Both of these foods are sold in the 'uncooked' state. The claim of the manufacturers of the cooked, or malted foods is that by the process to which they have been subjected, the 'insoluble starch is converted into soluble maltose and dextrin'.

The last column of the above table shows to what extent this rendering the starch soluble has occurred. Thus, we find oatmeal to yield but 3·85 per cent, to cold water, while several of the prepared foods yield 20 per cent, or more to this solvent.*

Of course the chief object sought in *boiling* porridge, is to render the starch soluble; and where conditions make it difficult, or impossible to properly cook one's porridge, there is doubtless an advantage in using a material that has already undergone some change in this regard. Whether or not the high prices at which these foods are sold are sufficiently warranted by the saving of fuel and time, under ordinary conditions of domestic life, is a question to be solved by each housekeeper for himself.

*The following attempt to explain the essential principles of nutrition in non technical language, has been made in deference to the advice of a friend, of whose opinions I entertain a high regard. I am fully aware of the dangers incident to an explanation of scientific matters by the analogical method, and I may have pressed the analogy too far in some points. I believe, however, that all that I have said is materially accurate; and shall be sufficiently rewarded if I have put the subject in such a form as to make it intelligible to non-scientific readers, so as to interest them in it, and induce them to make themselves acquainted with the more strictly technical terms in which alone the subject can be discussed to advantage.

Work is done whenever the tendency to rest is resisted. In this sense mere living implies work, for the beating of the heart and the flow of blood in the vessels means effort, although such effort is not conscious. The power to do work is spoken of as energy, and wherever work is done, energy is being expended. A locomotive engine in movement is an example of work being performed, and energy being expended. A man running, or walking, or even sitting still, so long as he is alive, is equally an instance of work being done, and of energy being expended. When we see an engine in movement, we know that fuel is being burnt within it; so when we see a man in movement, we know that fuel (food) is being consumed (digested) within him. The food of the engine (coal or wood) must not only be put into it, but must undergo combustion (oxidation) in the fireplace. So the fuel (food) of man must not merely be taken into his body, but must there undergo combustion (digestion) in order to furnish the energy necessary to do work. The food of man need not necessarily be taken in from *without*, since his own fat, may be consumed within him, just as the fireman of an engine, when coal is scarce, may break up the woodwork of his cab and burn it with his cushions and even his clothing in order to keep his engine going. It is evident that such a state of things could not last long; and so too of the consumption of a man's own tissues. He wastes away, and becomes mere skin and bone, and then he dies.—(ceases to go.) Not every kind of material is suitable for the nutrition of a locomotive engine, and there are degrees of value even among those forms of matter which may be used as fuel. So with man. Certain forms of matter are capable of being burnt within him to advantage, and long experience has proved that his energy is best derived from *fats*, *carbohydrates* and *proteids*, just as the energy of the engine is best derived from *coal*, *wood* or *oil*.

Energy may show itself in other ways than by movement; and the most notable of these other ways, is by the production of heat. A movement of what we call electricity (another form of energy) is constantly taking place in our trolley wires. When the wire breaks, and the free ends touch the roadway—which resists the passage of the electricity—tremendous heat is developed; if to the free ends of the wires carbon rods are attached, the heat and light produced constitute the arc-lamps so commonly employed in street lighting. The heat of the locomotive boiler is an expression of the energy produced by the burning of the fuel; and the heat of man's body—which is always about 98° Fah., although the temperature of the air round about him may be below zero—is an expression of a part of the energy produced by digestion of his food. It would be possible to measure energy by taking, for example, the amount that must be expended against the force of gravity in lifting a weight of one pound through a height of one foot; but in the study of digestion it is much more convenient to measure energy in

There is, however, another point of view from which these foods may be regarded, viz : their content in proteid matter. In this respect peameal excels them all. There is however good reason to believe that the proteids of the pea and bean, and of leguminose in general, are less easily digested by man than are the proteids of the cereal grains proper. Among these oatmeal takes first rank, but several of the prepared foods stand very well in this regard. If we take into account the mineral matter (ash) which

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terms of heat. The heat required to raise 1 gramme (= 15·5 grains) of water through 1 degree Centigrade (= $1\frac{4}{5}^{\circ}$ Fah.) is taken as the unit of energy, and is known as a (small) *calorie*. The energy that can be produced by the complete combustion (digestion) of 1 gramme of any kind of foodstuff may then be set down in Calories : and this has been done for the different cereal foods described in this bulletin. Just as the combustion of a ton of coal in an engine may produce more energy than the combustion of an equal weight of wood, so the digestion of a gramme of fat produces, in the human body, a greater amount of energy than the digestion of a gramme of sugar or starch or white of egg or lean beef. Expressed in calories, the energy producing power of common foods is as follows :—

1 gramme of the dry substance—

Fat (average for various fats)	9·3	calories.
Proteids (" " proteids)	5·71	"
Carbohydrates (average)	4·1	"

Of course, any failure to burn the coal completely to ashes in the engine will result in a reduction of the energy derivable from a given weight of it ; and just so, the failure to completely digest any part of our food means a reduction of the energy which we might derive from it. Now the possibility of completely burning the fuel in an engine depends partly on the nature of the fuel itself, and partly on the peculiarities of the engine. In a similar way the possibility of completely digesting our food depends partly on the character of the food and the way it is cooked, or otherwise prepared ; and partly upon the personal idiosyncrasy of the man himself. Whatever escapes digestion is not only useless, but in most cases harmful, since it consumes energy in the effort to ingest it and to egest it ; just as stones in coal cause not merely a negative harm, but a positive loss since they take up heat which would otherwise go to making steam.

It may be accepted as true that, under favourable conditions, fats (*e.g.* butter, beef and mutton fat, lard, cotton seed, olive and other oils, &c) and carbohydrates (*e.g.* starch, sugars, dextrin, &c.) can be completely burnt (digested) in the body, and therefore the number of calories quoted per gramme, represents an amount of energy that can really be obtained from them, whether burnt outside of the body, or digested within it. In the case of proteids (*e.g.* lean meat, egg, casein of cheese and milk, gluten of flour, &c.) on the contrary, the digestion within the body is never so perfect as to secure all the energy that would be derived from perfect combustion of these substances outside of the body. Careful experiments have shown that whereas 5·71 calories measures the energy per gramme of proteids fully oxidized outside of the body, the energy obtained from their digestion within the body varies from 3·8 to 4·4 calories.

This is because of the peculiar character of proteids in relation to nutrition, and requires explanation.

We need more than energy to keep any machine going. The parts of the machine wear out, and the further supply of energy producing substance (fuel) to drive it, can only result in destroying the mechanism. It must go to the repair shop. The human body has its own repair shop within itself, and it is from the proteid matters of our food that repairs to the body tissues are made. The blood is the circulating fluid by which this structural material is carried to the parts where it is wanted, and by which also, the debris, or worn out tissue, is got rid of. The special organs which eliminate this waste tissue are the lungs, the kidneys, the skin and the bowels ; while the organs which immediately supply new tissue—forming material to the blood are the lacteals (of the

is no less necessary to complete nutrition, we find marked differences among these foods. If one were to live entirely or principally upon these foods, it would be very necessary to take account of this. Finally, on account of its very high energy factor, we may lay stress upon the content of fat ; and here also oatmeal stands in the first place.

On the whole, I am of opinion that as a well balanced material for porridge, these analytical results justify me in claiming a very high, if not the highest place for oatmeal, and especially in the form of rolled oats.

Recognizing, however, as I do, that our knowledge of the intimate character of the components of cereals, and of their relative digestibility, is yet far from complete, it would be presumption in me to pronounce judgment in an unqualified way, in this matter.

In an appendix to this report I have put on record a considerable amount of work, which must be regarded as a contribution towards the development of a fuller knowledge of this highly important subject.

I have the honour, to be, Sir,

Your obedient servant,

A. McGILL,

Assistant to the Chief Analyst.

---

small intestine) and the lymphatic duct. The worn out proteid material is largely got rid of as urea, uric acid and other substances, which still contain latent energy, thus accounting for the apparent loss of energy occurring in the digestion of proteid foods.

Cereals, as the analytical numbers in the tables prove, contain all the substances necessary for nutrition, i.e. proteids, fat and carbohydrates ; but these are contained very disproportionately. (It must not be forgotten that mineral matter is needed in a complete food ; this also is found in cereals.) Whole wheat may be taken as having the following average composition :—

Proteids	12·3
Fat	1·7
Carbohydrates	67·6
Mineral matter	1·8
Water	14·0
Cellulose	2·6

Cellulose we must count as waste in food. It is the substance of which wood consists and contains much energy, but the human organism is not able to make use of this energy, in other words, cellulose is indigestible. May it not be that proteids and carbohydrates and even fat exist, which like cellulose, contain energy that the human system cannot utilize ? The answer is undoubtedly, yes ! And even among proteids, &c., that are digestible, and hence available for food, degrees of digestibility exist. The value of a food stuff is therefore not dependent merely upon its content of proteid or carbohydrate or fatty matter, but also upon the digestibility of such matter. Pea flour contains fully double the proteid matter of wheat flour, but is not on that account twice as valuable for human food. Almonds and other nuts contain still more proteid matter, but we should soon find our digestion seriously disturbed if we tried to live on almonds. Whoever shall discover a method of preparing nuts, beans and peas, so as to render them easily digestible will confer a great boon on humanity. There are similar differences in the digestibility of carbohydrates. Cellulose (woody fiber) and sugar are both carbohydrates ; but while the latter is a valuable food, the former has no value. Starch is a carbohydrate, and raw starch can be slowly and with difficulty it is true, digested. Its value is immensely increased by cooking. The various processes of cooking starch have all for their object, the increase of its digestibility ; and this is effected by converting it, more or less completely, into the substances known as *soluble starch*, *dextrin*. *maltose*, *dextrose*, &c. No doubt these substances have a varying value for the human animal, among themselves ; but further study of this interesting subject must be left to those who care to give time to it. I may mention Mandels' translation of Hammarsten's Physiological Chemistry (John Wiley & Sons, New York, 1900) as a reliable and very readable presentation of the subject. A. McG.

APPENDIX TO BULLETIN ON CEREAL FOODS.

At the meeting of the American Association of Official Agricultural Chemists, held at Washington in 1900, it was decided to make a systematic effort to outline methods for the examination of foods. The subject, cereal products, was allotted to me; but I was not able, during the following year, to prepare any work worthy of presentation to the association. During the last six months I have taken advantage of the opportunity offered me by the collection of breakfast foods, and their submission to me for analysis, to carry on some research work in connection with this subject; and I presented a provisional report upon the subject of cereal analysis to the Washington meeting this year, although I was not privileged to be personally present at the discussion. This provisional report was based upon the work given in the appendix following; and although far from exhausting the subject with which it deals, I trust that it may do something towards aiding food analysts in this difficult and exceedingly important department of our work.

A. McGILL.

December 10, 1902.

PREPARATION OF THE SAMPLES.

In the work described in the sequel, finely ground samples (flours) were not further prepared than by thorough mixing. Samples, like most of the breakfast foods, which occur in granules or in flakes, were passed through a mill several times, until about 75 per cent of the material was fine enough to pass through a sieve of 1 mm. mesh, while the whole passed through a 2 mm. sieve. The following numbers illustrate the degree of fineness obtained:—

	2 mm. sieve. p.c.	1 mm. sieve. p.c.	0·5 mm. sieve. p.c.
A sample of 'Grape nuts'	100	72	18
" 'Life chips'	100	74	21
" 'Malta Vita'	100	71	25

DETERMINATION OF MOISTURE IN CEREALS.

Two methods of working are evidently available, viz.:—

1. By loss of weight on exposure of the sample to a dessicating atmosphere.
2. By absorption of moisture in some hygroscopic substance contained in a weighed tube.

The last may be called the 'positive method.' It has the disadvantage of requiring more time and labour in its execution, since each sample must be operated on independently. It has the merit of enabling the volatile matters which escape on heating the sample to be separated by using absorbents of special character. This method has not been examined, but will be investigated as leisure permits.

The results obtained by the 'method of loss' have been studied. The loss of weight is not necessarily water only. Gaseous products, other than vapour of water, may come off under the influence of heat. These may include carbon dioxide and hydrocarbons, especially if the temperature is allowed to rise much above 100°. It would be better to describe the result of this treatment as 'Loss of weight on drying'; or volatile matter lost at the temperature of the experiment.

Query 1.—Do cereals continue to lose weight by prolonged exposure to hot air?

A sample of Strong Bakers' flour was exposed at 95° C. to a current of air—used from 1 to 2 grammes.

		Loss of weight.	
		After 7 hours.	After 22 hours.
Flour	(a)	13·27	12·47 per cent.
	(b)	13·10	12·60 "
	(c)	13·10	12·55 "
	(d)	12·90	12·40 "
Mean		13·09	12·50 "

Inference.—When flour is heated for many hours in air at 95° C. a point is reached beyond which it begins to increase in weight.

On exposing this sample at 105° in an atmosphere of dry coal gas for three hours, the loss of weight was—(a) 13·7 ; (b) 13·9 ; mean=13·8 per cent.

QUERY 2.—Would a lower temperature than 95° serve the purpose of drying in air?

The same sample (Strong Bakers' flour), together with samples of 'pastry flour,' 'corn starch' and 'Force'—a prepared cereal food—were submitted to a current of air at 70° C.—(2·5 grammes on watch glasses) :—

Time = 15 hours.

Strong Bakers' flour	(a)	11·04	=11·06 per cent.
	(b)	11·08	
Pastry flour	(a)	12·48	=12·68 "
	(b)	12·88	
Corn starch	(a)	10·48	=10·62 "
	(b)	10·76	
Force	(a)	10·28	=10·48 "
	(b)	10·68	

On further subjecting these samples to a temperature of 105°, in air, the loss of weight was as follows :—

Strong Bakers' flour	(a)	13·76	=13·52 per cent.
	(b)	13·28	
Pastry flour	(a)	14·32	=14·30 "
	(b)	14·28	
Corn starch	(a)	12·36	=12·24 "
	(b)	12·12	
Force	(a)	11·36	=11·50 "
	(b)	11·64	

Inference.—An exposure of 15 hours in air at 70° C. does not thoroughly dry cereals.

QUERY 3.—Would it be possible to obtain the maximum *loss of weight* by weighing at intervals and noting the time at which the samples ceased to lose weight?

The above samples were exposed on watch glasses in a current of air at 105° and weighed at intervals of *one hour* until maximum loss of weight was obtained.

Strong Bakers' flour	(a)	13·68	=13·72 per cent.
	(b)	13·76	
Pastry flour	(a)	14·21	=14·22 "
	(b)	14·20	
Corn starch	(a)	12·16	=12·26 "
	(b)	12·36	
Force	(a)	12·12	=12.06 "
	(b)	12·00	

Unfortunately, the only one of these samples which was dried in coal gas, is the first. It gave 13·8 per cent loss, under these conditions.

Inference.—It is probable that a very close approximation to accuracy would result from weighing at fixed intervals of one hour, and accepting maximum loss of weight at 105°, in air, as the datum wanted.

For the following study, which is in the main corroborative of the foregoing, six samples of cereal foods were chosen.

Quantities of 2·5 grammes, on watch glasses, were exposed at 100° C., to an atmosphere of dry coal gas.

	Loss of Weight.					
	At 100°.					At 110°
	2 hours.	4 hours.	8 hours.	10 hours.	16 hours.	4 hours.
Malt breakfast food, No. 17850.	9·28	9·80	10·12	10·24	10·48	10·52
Rolled oats, No. 23333*(b)*.	10·52	.....	10·80	10·92	11·08	11·08
Ralston breakfast food, No. 20230.....	11·64	12·08	12·24	12·40	12·60	12·60
Force (special sample)	13·68	14·12	14·28	14·40	14·56	14·56
Malt breakfast food, No. 20225*(b)*.....	9·20	9·76	10·04	10·16	10·32	10·36
Grape nuts, No. 22034*(b)*..	7·56	8·16	8·52	8·68	8·88	9·00

The figures in the last column give the loss of weight from raising the temperature to 110°., for 4 hours longer; and indicate that drying is complete at 100° C. in 16 hours. The full time of 16 hours appears to be necessary at this temperature. An error of nearly one-fourth of one per cent would result from taking the weight after 10 hours, as final.

Other portions of 2·5 grammes of these same samples were used in the following work. Exposure at 95°–96° in a current of air, for varying periods, gave these results:

		Loss of Weight.				Maximum Loss of Weight.	Loss in Coal Gas at 100°.
		1 hour.	2 hours.	19 hours.	21 hours.		
Malt breakfast food (17850).....	(a)	9·20	9·60	10·00	.....	10·00	10·52
	(b)	5·80	9·40	9·88	.....		
Rolled oats (23333*b*).	(a)	10·24	10·48	10·56	.....	10·56	11·08
	(b)	10·48	10·52	10·44	.....		
Ralston breakfast food (20230).. .	(a)	11·16	11·44	12·12	.....	12·24	12·60
	(b)	11·28	11·64	12·24	.....		
Force (special).....	(a)	13·24	.....	14·24	.....	14·24	14·56
	(b)	13·44	13·72	13·72	13·84		
Malt breakfast food (20225*b*)... ...	(a)	8·96	9·88	9·88	.....	9·88	10·36
	(b)	9·48	9·64	9·76	9·76		
Grape nuts (22034).....	(a)	7·04	.....	8·36	.....	8·56	9·00
	(b)	7·72	8·08	8·20	8·56		

Inference.—From these results one is compelled to conclude that even 21 hours at 96° does not fully dry cereals, or that the point of drying has been passed before the expiration of this time, and increase of weight (by oxidation) has begun to take place. This is consistent with experimental work already recorded.

The following work further illustrates the fact that attempts to dry cereals in air, at 98° to 100°, fail to drive off all the volatile matter, or permit of oxidation to such an extent as to show less than the true percentage of volatile matter, when this is calculated from apparent loss of weight :—

'Malt Breakfast Foods.'	Coal Gas at 105 for 3 hours.	Air at 98 for 20 hours.	Difference.
No. 4,309	10·56	9·70	0·86
" 17,850	9·67	8·95	0·72
" 21,232	8·09	7·45	0·64
" 22,040	9·59	9·15	0·44
'Force.'			
No. 4,308	11·40	8·94	2·46
" 17,427	10·65	9·85	0·80
" 17,851	11·25	8·95	2·30

Query 4.—What is the amount of unavoidable experimental error in the method of drying in coal gas ?

Duplicates already quoted show that the differences obtained in these may be very large when the drying is done in air. The following duplicates were worked as nearly as possible under like conditions, in dry coal gas :—

DUPLICATES ; *loss in 2·5 hours at 110°.*

'Malt Breakfast Food.'			Difference.
No. 4,309	11·00	and 10·56	0·44
" 17,850	10·10	" 9·67	0·43
" 21,232	8·80	" 9·20	0·40
" 22,040	10·40	" 9·59	0·81
'Force.'			
No. 21,226	12·50	and 12·90	0·40

Inference.—An error of about 0·5 per cent is unavoidable, and the method must not be held to any closer interpretation.

Hence determination of fat by any method involving determination of moisture must be altogether untrustworthy.

Fat.—(Petroleum Ether Extractive) by methods that involve the estimation of moisture.

It is apparent that the following results have no value, except as illustrating the impossibility of accurately determining fat by indirect methods.

Five grammes was interstratified with fibrous asbestos in Macfarlane tubes, and extracted, in Soxhlet tubes, for eight hours. In most cases the solvent was applied

without previous drying of the sample. The final drying was made at 105°-110° C. in air.

Sample.	Total loss to Petroleum Ether and Dry Air. (a.)	(b.)	Mean.	Moisture lost at 105°–110°.	Difference (Fat).	Fat (Ether Extract) obtained by direct Weighing.
					p. c.	
'Malt Breakfast Food'—						
4,309	10·96	11·28	11·12	10·78	0·34	.....
17,850	9·88	10·20	10·04	9·89	0·15	.....
21,232	9·12	.....	9·12	9·00	0·12	.....
22,040	10·76	.....	10·76	9·99	0·77	1·15
23,330	9·48	.....	9·48	9·20	0·28	.....
'Force'—						
4,308	11·52	.....	11·52	11·40	0·12	.....
17,427	10·72	.....	10·72	10·65	0·07	.....
17,851	12·36	.....	12·36	11·25	1·11	1·26
'Malta Vita'—						
17,426	12·00	.....	12·00	11·15	0·85	1·23
'Grape Nuts'—						
22,034	9·96	10·24	10·10	9·50	0·60	0·61
'Life Chips'—						
Special	11·24	.....	11·24	9·90	1·34	1·69
'Ralston Breakfast Food'—						
20,230	13·20	13·20	13·20	12·50	0·70	1·42
21,684	15·12	.....	15·12	13·64	1·48	1·65

The indirect method is untrustworthy inasmuch as (1) the difference between duplicate tests is often greater than the total amount of fat; (2) the preceding study of moisture determination shows an experimental error of about 0·5 per cent, which error would invalidate any results obtained for fat, in which the moisture per centage had to be deducted.

The following mode of operating has been found satisfactory:—Quantities of the material varying from 2·5 to 5 grammes are wrapped in fat-free filter paper and tied with ordinary sewing cotton. The cartridges so formed are dried in coal-gas, at 105°; and extracted in a Soxhlet tube with mixed pretroleum and ethyl ethers; or with petroleum ether only. The ether must be rectified, and found to leave no residue on evaporation. The extractive is evaporated to dryness in tared glass capsules, and weighed. If desired, the fat so recovered may be examined as to its refractive index, and its behaviour with reagents. The quantity obtained is, however usually too small to permit of detailed examination; and if the ordinary physical constants are to be determined, it is necessary to make a special extraction of a larger quantity of material.

The numbers given in the last column of the preceding table, were obtained by operating in this way.

It was noted that the fat recovered from the cereal foods examined did not gain weight on continued exposure to air at 100° C. for 15 hours.

ASH.

It is usually recommended to carry out the operation of 'ashing' in a muffle, maintained at a low red heat. This method is tedious in the case of cereals, which burn very slowly. It is advantageous to treat the partly burnt material with water, filter, and complete the incineration of the residue, (with the filter) finally adding to it the solids obtained by evaporating the filtrate to dryness.

Hebebrand (Zeit. für Untersuch, der Nahr. and Genussmcttel, 1902, 719—through Analyst, 1902, 342) recommends a platinum dish having circular holes just below its

edge. This is covered by a lid and chimney made of aluminium ; and it is claimed that incineration is complete in about half the usual time with this apparatus.

The following determinations have been made in platinum dishes, over a Bunsen burner. The heat is kept low at first, but finally raised to distinct redness.

With samples of *Malt Breakfast Food*, the following percentages of ash were obtained :—0·58, 0·58, 0·54, 0·56, 0·52, 0·56, 0·56, 0·39, 0·47, 0·66, 0·60, 0·60 ; mean value, 0·56 per cent.

With samples of 'Force' :—2·92, 2·76, 2·72, 2·60 ; mean value, 2·75 per cent.

With samples of Life Chips :—2·82, 2·38 ; mean value, 2·60 per cent.

With samples of Ralston Breakfast Food :—0·70, 0·86 ; mean value, 0·78 per cent.

Grape nuts, gave 1·64 per cent.

Rolled oats, gave 1·68 per cent.

CRUDE FIBRE.

This datum is necessarily of an indefinite character. In the following illustrative table, the work recorded was done after the method recommended by the association of American Agricultural Chemists. A variation in manipulation, by the introduction of a large centrifuge (see description of centrifuge at end of bulletin) somewhat facilitated the filtration. After the acid treatment, two to three volumes of alcohol are added, and the liquid whirled for twenty minutes or so. The addition of alcohol is necessary, because the separated fibre is of nearly the same specific gravity as the menstruum. After alkali treatment, direct filtration has been found most satisfactory : the centrifuge being here of no advantage.

	Crude Fibre, p. c.—	
'Malt Breakfast Food' —		
No. 4309	0·94 : 0·90	
17850	1·08	
20225	1·24	
21232	0·96	Mean value=1·05
21685	1·00	
22040	1·44 : 1·08	
23330	0·80 : 1·06	
'Malta Vita' —		
No.17426	2·50 : 2·30	Mean value=3·15
21225	3·90	
'Grape Nuts' —		
No.22034	2·6 : 1·46	Mean=2·03
'Life Chips'—		
Special	2·90	
'Ralston Breakfast Food'—		
No.21684	1·64 : 1·72	Mean =1·68
'Force'—		
No.17851 *(b)*	2·60	
'Rolled Oats'—		
No.23333 *(a)*	3·14	

NITROGEN.

The total nitrogen has been worked on 1 gramme of material, by the Gunning-Kjeldahl method.

The soluble nitrogen has been obtained by evaporating to dryness, in a Kjeldahl-digestion flask, 75 cc of a 10 per cent aqueous solution and treating the residue as above.

Evaporation is conveniently effected by aspirating a current of air through the flask, while this is on the water bath.

In a few cases this estimation has been made on a 5 per cent solution, and in every instance the dissolved nitrogen so obtained was notably higher. This would seem to point to the difficult solubility of the forms in which nitrogen is present in these substances.

	Nitrogen—Per Cent.		
	Total.	Soluble.	
		Ten p.c. Soln.	Five p.c. Soln.
'Malt Breakfast Food'—			
No. 4309	2·12	0·31	....
17850	1·965	0·14	0·21
20225 (*a*)	1·96	0·15	0·25
20225 (*b*)	1·98	0·14	...
21232	1·82	0·17	0·28
21685	2·21	0·19	....
22040	1·92	0·155	0·241
23330	1·96	0·16	
Mean value	1·99	0·18	
'Force'—			
No. 4308	1·90	0·23	
17427	1·76	0·26	
17851 (*a*)	...	0·23	
17851 (*b*)	...	0·17	
21226	1·95	0·19	
Special	1·79	0.15	
Mean value	1·85	0·21	
'Malta Vita'—			
No. 17426	1·52	0·16	
21225	1·63	0·25	
Mean value	1·58	0·21	
'Grape Nuts'—			
No. 22034 (*a*)	1·90	0·30	
22034 (*b*)	1·93	0·30	
Mean value	1·92	0·30	
'Life Chips'—			
No. 21230	1·51	0·25	
Special	1·59	0·19	
Mean value	1·55	0·22	
'Ralston Breakfast Food'—			
No. 20230	2·29	0·26	
21684	1·70	0·25	
Mean value	2·00	0·26	
'Rolled Oats'—			
No. 23333 (*a*)	2·10	0·12	
23333 (*b*)	1·96	0·13	
Mean value	2·03	0·13	
Granulated oatmeal	2·08	0·18	
Peameal	4·41	1·19	
Cornmeal, ordinary	1·64	0.26	
" golden	1·43	0·07	

That differences in the nutritive value of the azotized components of cereals exist is a generally accepted fact. The proteids are doubtless of more importance as food material than the amidic substances, which are possibly intermediate products of their metabolism.

It is now equally certain that the proteids themselves vary in nutritive value. The following quotation is from the Monatsh. fûr Chemie, 1901, 991—through the Jour. Soc. Chem. Indust., 1902, p. 132 :—

'A. Jolles has previously shown that there are essential differences in the proteids, and that, according to their constitution, a certain portion of the nitrogen is converted into urea on oxidation. Parallel experiments on man show that casein (which gives 73 per cent of its nitrogen as urea on oxidation) left 16·7 per cent of its nitrogen unabsorbed, while fibrin (which gives 45 per cent of its nitrogen as urea on oxidation) left 34·3 per cent of its nitrogen unabsorbed under similar conditions. Thus the physiologically nutritive value of the proteins in regard to nitrogen depends on the amount of the urea forming groups.'

It is quite probable that similar differences exist among the proteids of cereals ; and possibly among the different proteids of the same cereal there may be found characteristic properties which shall justify efforts to cumulate one or another species of proteid for special food purposes.

I have placed the soluble nitrogen (amide nitrogen ?) on record without any attempt to interpret it.

COLD WATER EXTRACTIVE.

This has been prepared by treating 30 grammes of the sample with 280 cc. distilled water. The resulting solution is nominally of 10 per cent strength—on the assumption that the density of the sample is 1·5. This assumption seems justified by the fact that the mean density of wheat flour is 1·56.

The solution is made by shaking the sample with the solvent for a period of 18—20 hours (over night) on an apparatus which I have called a 'rotator.' This consists of a wooden disc, to which 4 Erlenmeyer's of about 350 cc. can be attached radially. The wheel is 15 inches in diameter, and its surface is cut out in such a way that the Erlenmeyer flask fits into a depression, where it is securely held by rubber bands secured to small brass hooks screwed into the wheel. The whole is driven by a small water-motor at the rate of 30—40 revolutions per minute.

The separation of the insoluble matter is facilitated by the use of a large centrifugal machine (see description at end) making about 1,500 revolutions per minute. After 20 minutes in this apparatus the decanted liquid easily passes through ordinary filter paper, about 200 cc. being obtained, as a rule.

Unless the centrifuge is used, a very long sedimentation is needed, and it is difficult to get a liquid which can be filtered. Probably it would be best to work with 5 per cent solutions when a centrifuge is not available.

On the solution so obtained (solution A) the following estimations are made :—

1. Density.
2. Total solids in solution.
3. Reaction with iodine.
4. Reducing substances (Fehling solution).
5. Dissolved nitrogen.
6. Dextrine (matters precipitated by alcohol).
7. Preparation of solution B.

Work on solution A—(i.e., 10 per cent. solution).

1. *Density* has been determined by the sp. gravity bottle at 15·5°C.
2. *Total solids*—20cc.—evaporated to constant weight at 100°C.—on asbestos fibre.
3. *Reaction with Iodine*—1 to 2 cc. is very much diluted with water, and a very dilute solution of iodine added. It is thus easy to avoid mistaking the brown colour due to erythro-dextrin. Where soluble starch as well as dextrin is present, the blue of the starch appears before the brown-red of dextrin.

Thus 'Force' gives *blue* and then *brown*.
'Grape Nuts' gives *brown*.
'Oatmeal' and some other foods give *no colour*.

4. *Reducing substances*—25cc (= 2 grammes) is made up to 50cc. with water, and heated to 100°C. This is poured into 50 cc. of Fehling's solution, also at 100°C., and the mixture kept at this temperature for ten minutes. The precipitated Cu_2 0 is then rapidly filtered off, and washed on an asbestos filter, using the pump. It is finally washed with strong alcohol, dried and weighed. The $Cu._20 \times 50 = Cu._20$ per cent .as in the tables below.

5. *Dissolved nitrogen* has been already referred to. (See page 46.)

6. *Dextrin*—25 cc. (=2 grammes) is concentrated to 10 cc., and any matters thrown out of solution by this operation are separated by filtration. To the filtrate (=10 cc.) is added 100 cc. of alcohol (density = 0·810). The precipitate is collected on a tared filter, dried and weighed. Weight × 50 = dextrin per cent. The 'dextrin' so obtained cannot, of course, be regarded as pure. I have not had leisure to fully examine the character of the substances precipitated by alcohol; but shall investigate this matter at the first opportunity.

An examination of the tables will show that 2 to 3 per cent. of substances precipitated by alcohol is sometimes present when no iodine reaction for dextrin (erythro-dextrin) occurs.

The following table gives a synopsis of the results of work, as indicated, on *Solution A* :—

Mean Results Obtained.

Breakfast Foods.	Density of 10 p.c. solution.	Dry solids p.c.	Reaction with Iodine.	Reducing substances. As Cu_2 0 p.c.	'Dextrin.'
Malt Breakfast Food	1·0051	13·00	None to brown.	7·29	3·24
Force	1·0129	29·60	Blue to brown.	7·00	14·48
Malta Vita	1·0127	30·88	Blue to brown.	16 20	9·26
Grape Nuts	1·0199	49·50	Brown	23·80	24·87
Life Chips	1·0087	19·30		9·85	12·16
Ralston Breakfast Food	1·0035	7·50	None	0·0	2·62
Rolled Oats	1·0025	6 19	None	0·0	3·58
Oatmeal	1·0020		None	0·0	
Peameal	1·0076		None	0·0	
Common Cornmeal	1·0035		None	0·0	
Golden Cornmeal	1·0019		None	0·0	

The aqueous solution (solution A) is, of course, strongly dextro-rotatory, owing to its content of dextrin, soluble starch and other optically active substances having right hand rotation. The solution is, however, always more or less opalescent, and cannot be read in the polarimeter without clarification. I have found the following mode of clarifying both simple and efficient :—

80 cc. solution A (=8 grammes material), is treated with 16 cc. of a 7 per cent alum solution, followed by 4 cc. of ammonia solution of such a strength as to precipitate all the alumina and leave a slight excess of ammonia. (The ammonia solution is about

1·85 normal strength.) On gently warming, the hydrate of alumina separates in flocks, and the liquid is easily filtered.

Filtrate = *Solution B.*

Solution B, is read at 20° C. in a 2 dm. tube. The reading (S–V–sugar scale units) is multiplied by $\frac{100}{8} = 12 \cdot 5$, to convert it to a percentage on the sample; i.e., to a concentration of 100 per cent. The rotation is thus expressed in the analytical tables.

Since, however, the optical activity is due to substances dissolved from the cereal, and not to the whole weight of the cereal, it is preferable to state the rotation as a *specific angular rotation* on the soluble solids.

This calculation is made by the formula,

$$S = \frac{a}{l \times \frac{c}{100}} = \frac{SV^\circ \times 0{\cdot}3468}{\frac{c \times p}{100}} = \frac{SV^\circ \times 0{\cdot}3468}{2\,p} = \frac{SV^\circ \times 0{\cdot}1734}{p}$$

or, Log S = Log SV° + log ·1734 — log. P.

where p = weight of soluble matter per 1 cc. of solution A, and 0·3468 is the A.O.A.C. factor for converting S V degrees into rotary degrees.

In the following table the rotatory power is stated in both ways, and the ratio of dextrin found to the total soluble matter is calculated.

OPTICAL (ROTATORY) VALUE OF SOLUBLE MATERIAL.

Name of Cereal.	S.V. degrees per 100 grammes.	Percentage soluble matter.	Specific rotation of soluble matter.	'Dextrin' precipitate by alcohol.	Ratio of Dextrin to soluble matter.	Iodine reaction of Solution A.
Malt Breakfast Food.	54·7	13·0	73·0	3·24	24·9	None to brown.
Force . . .	122·7	29·6	72·0	14·48	49·0	Blue to brown.
Malta Vita . .	194·0	30·88	109·0	9·26	30·0	Blue to brown.
Grape Nuts.	301·0	49·5	105·4	24·87	50·2	Brown.
Life Chips . . .	140·0	19·3	125·7	12·16	63·0	

The gyrodynat of *dextrin* is about 200°; that of *soluble starch* varies from 196° to 200°. Hence the reading given above cannot in any way serve to distinguish between these two substances. The ratio of the alcohol precipitate to the total soluble matter, and the reaction with iodine should, however, furnish a clue to the relative proportions of these substances. In order to secure further information on this point I prepared a third solution, as follows:—

Solution C.—50 cc. of the clarified solution B (= 4 grammes sample) is treated with 2 cc. strong HCl, and heated to 65° C. for 15 minutes. The cooled liquid is neutralized by ammonia, and alumina cream is added to make a volume of 75 cc. The filtrate (solution C) is read at 20° C., and the reading multiplied by $\frac{100}{6} = 16\frac{2}{3}$, to convert to S.V. degrees per 100 grammes.

Both *dextrin* and *soluble starch* are converted into dextrose by prolonged treatment with hydrochloric acid, the former more readily than the latter.* My object was

*An important paper on the hydrolysis of starch by acids, by Rolfe and Defren, was published in Journal Am. Ch. Soc., 1896—p. 869. The authors find that the law (discovered by Brown and Morris in 1885) governing the conversion of starch by diastase, is essentially true of the conversion by acids. Their results show that the copper reducing power of the solution in progress of inversion, bears a constant relation to the optical value, under the most varying conditions of acidity, dilution, time of digestion, kind of acid used and pressure. Their conclusions are (1) In any homogeneous, acid converted starch product, irrespective of the conditions of hydrolysis, the specific rotatory power always represents the same chemical composition. (2) But three simple carbohydrates, possible in molecular aggregates, exist in the solution of a starch product hydrolyzed by acids (leaving out traces of reversion products.)

to secure conditions which would more or less closely discriminate between these substances. The gyrolynat of dextrose (+ 53) is so much lower than that of either dextrin or soluble starch that a very decided alteration of rotatory power should result from this treatment. The numbers obtained are given in the analytical tables; but are so unsatisfactory that it is evident the inversion has proceeded quite irregularly and indefinitely. This is another point in which further work is required. In nearly every case the reading on inversion is lower than the original reading; but the extent of its change bears no simple relation to any known differences in the character of the solutions.

Starch.—It has not been possible to make a direct estimation of unchanged starch in all the samples. This estimation has, however, been made in several samples of the following brands, viz.: Malt Breakfast Food; Force, Grape Nuts and Life Chips.

The insoluble matter from 5 grammes of the sample was boiled for three hours with dilute hydrochloric acid (after Sachsses method), cooled, neutralized and made up to 500 cc. Aliquot portions of this solution were treated with Fehling solution, and the precipitated cuprous oxide calculated into starch (= dextrose × 0·92). The following results were obtained:—

STARCH.

Malt Breakfast Food	60·35 65·34	= 62·85 per cent.
Force	36·30 37.20	= 36·75 "
Grape Nuts	32·03 32·98	= 32·50 "
Life Chips	40·84 45·37	= 43·10 "

A. McGILL

ANALYSIS OF BREAKFAST FOODS

MALT BREAK

Date of Collection.	Description of Sample by Food Inspector.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher.	Serial Number.	Designation Number.	Moisture. Loss of weight at 110 in coal gas.	Fat. Petroleum ether extractive.	Ash.
1902.						p. c.	p. c.	p. c.
July 31	Breakfast Food...	Sanderson & Co., Charlottetown, P.E.I.	The Malted Cereal Co., Montreal.	1	4309	11·00 10·56	.....	0·58
						10·78		
" 28	Cereal Breakfast Food.	G. M. & A. A. Barker, St. John, N.B.	" ..	2	17850	10 10 9·67	....	0 58 0·54
						9·89		0 56
Aug. 6	Malt Breakfast Food.	S. L. Crop, Kentville, N.S.	" ..	3	202257	10·20 10 60		0 56
						10·40		
" 6	" " ..	" " ..	" ..	4	202258	9·74	1 10	
July 24	" " .	Hovey & Son, Cobourg, Ont.	..	5	21232	8·08 9·02	..	0·52 0·56
						9·00		0·54
" 30	" " .	F. Filion, Vancouver, B.C.	" ..	6	21685	11 30 10·50	0·85	0·39 0·47
						10·90		0·43
" 29	" " ..	F. A. Hatfield, Calgary	" ..	7	21703		..	...
" 23	" " ..	C. W. Griffin, Wingham, Ont.	" ..	8	22040	9 59 10·40	1·19 1 10	0·66 0·60
						10·00	1·15	0·63
" 21	" " ..	J. B. Orr, Lennoxville, P.Q.	" ..	9	23330	9·20	..	0·60
					Means..	9·99	1 03	0·56

* Precipitate by alcohol, from water extract.

Proteids (calculated from mean total nitrogen × 6·25) = 12·44 per cent.
Mean calories per 1 gram = 4094·8.

SESSIONAL PAPER No. 14

FAST FOOD.

Crude Fiber.	Nitrogen. Total.	Nitrogen. Soluble.	Cold Water Extractive. Density of 10 p. c. solution.	Cold Water Extractive. Solids dry at 100 C.	Cold Water Extractive. Iodine reaction.	Cold Water Extractive. Dextrin.	Cold Water Extractive. Substances reducing Fehling Solution. Cu_2O per 100 grammes. Before inversion.	Cold Water Extractive. Substances reducing Fehling Solution. Cu_2O per 100 grammes. After inversion.	Cold Water Extractive. Rotation in 2 dm. tube, per 100 grammes. Before inversion.	Cold Water Extractive. Rotation in 2 dm. tube, per 100 grammes. After inversion.	Remarks.
p. c.	p. c.	p. c.		p. c.			p. c.	p. c.			
0·94 0·90 0·92	2·12	0·31	1·0043	12·00	. . . .		1·88	5·52	6·45	+27·5	+30·0	Starch granules mostly entire; but little cellular tissue visible; starch apparently wheat and oats (?) possibly barley.
1·08	1·97 1·96 1·96	0·14	1·0055	12·10	None.		2·24	7·00	7·36	+65·0	−75·0	
1·24	1·96	0·15	1·0047				3·44					
. . .	1·98	0·14 0·14 0·14	1·0058	14·10	None.		3·44 3·24 3·34	7·90	8·85	+68·8 +67·5 +68·2	. . . . +60·0 +60·0	
0·96	1·82	0·17	1·0043		. . .		. . .	. . . .	. . . .	. . . . .	. . . . .	
1·00	2·21 2·21 2·21	0·19	1·0056	13·30	Brown		4·00			+62·5	+70·0	
. . . .	. . . .	. . . .	. . . .	. . . .	. . . .		. . . .	. . . .		. . . .	. . . .	This sample did not come to hand.
1·44 1·08 1·26	1·92	0·16 0·15 0·155	1·0046 1·0056 1·0051	12·60 13·36 12·98	. . . . .		2·84	8·75		+37·5	+40·0	
0·80 1·06 0·93	1·96	0·16	1·0056	13·50	Brown		4·95		. . . .	+67·5	+46·6	
1·05	1·99	0·18	1·0051	13·00			3·24	7·29	7·55	+54·7	+53·6	— Direct estimation of starch (unchanged) gave 62·85 per cent.

'FORCE'

Date of Collection.	Description of Sample by Food Inspector.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher.	Serial Number.	Designation Number	Moisture. Loss of weight at 110 in coal gas.	Fat. Petroleum ether extractive.	Ash.
1902.						p. c.	p. c.	p. c.
July 31	Breakfast Food....	Beer & Goff, Charlottetown, P.E.I.	Force Food Co., Buffalo, N.Y.	10	4308	11·4	.....	2·92
Aug. 11	Force	D. W. McLean, Winnipeg.	"	11	17427	10·65	.....	2·76
July 28	Cereal Breakfast Food.	Van Wart Bros., St. John, N.B.	"	12	17851*a*	11·25	.....	2·72
28	" ..	" ..	" ..	13	17851*b*	11·20 10·70 10·95	1·26	...
" 22	Force.....	P. Bruneau, Montreal..	" ..	14	21226	12·5 12·9 12·7	.....	2·60
" 22	"	" ..	" ..	15	Special	14·54 14·59 14·56	1·26 1·30 1·28	
					Means..	11·92	1·27	2·75

MALTA

Aug. 11	Malta Vita (concentrated malted food).	Hardy & Buchanan, Winnipeg, Man.	Battle Creek Pure Food Co.	16	17426	11·5 10·8 11·1	1·23	2·90
July 22	" ..	P. Bruneau, Montreal..	" ..	17	21225	12·0 10·2 11·1	1·28	3·10
					Means..	11·1	1·25	3·00

* Precipitate by alcohol from water extract.

FOOD.

Crude Fiber.	Nitrogen. Total.	Nitrogen. Soluble.	Cold Water Extractive. Density of 10 p. c. solution.	Cold Water Extractive. Solids dry at 100° C.	Cold Water Extractive. Iodine reaction.	Cold Water Extractive. Dextrin.	Cold Water Extractive. Substances reducing Fehling Solution. Cu_2O per 100 grammes. Before inversion.	Cold Water Extractive. Substances reducing Fehling Solution. Cu_2O per 100 grammes. After inversion.	Rotation in 2 dm. tube, per 100 grammes. Before inversion.	Rotation in 2 dm. tube, per 100 grammes. After inversion.	Remarks.
p. c.	p. c.	p. c.		p. c.			p. c.	p. c.			
.. ..	1·88 1·93	0·21 0·25	1·0118	26·3	Blue ..	17·0	6·3	..	−217·5	+100·0	Starch granules, mostly broken, and much fibrous tissue. Apparently wheat starch.
	1·90	0·23									
.....	1·76	0·26	....	36·6	.. ..	.....	6·7	.. ..	+112·5	106·6	
..	....	0·23	1·0186	38·2	Blue-brown.	24·16	3·9		+256·7	173·3	
		0·23		40·1							
		0·23		39·0							
2·60	..	0·16	1·0084	8·9	.. ..	8·36	7·75	5·35	+ 95·0	+ 23·3	
		0·18	1·0082	12·9		8·32		4·80	+ 95·0	+ 40·0	
		0·17	1·0083	10·9		8·34		5·05	+ 95·8	+ 32·6	
.....	2·04 1·86	0·19	1·0129	34·7 35·1	.. ..	10·72 10·64	10·55	9·85	−177·0	+130·0	Proteids (from mean total nitrogen × 6·25) = 11·56 p.c.
	1·95			34·9		10·68					
.....	1·79	0·15	.. ..	.. ..	.. ..	12·8 11·6	.....	.....	.....	.....	Calorific value = 3845·1 calories per gram.
						12·2					
2·60	1·85	0·21	1·0129	29·6	... ..	14·48	7·00	7·45	−122·7	−108·5	Direct estimation of unchanged starch gave 36·75 p.c.

VITA.

2·50	1·53	0·15	1·0126	28·75	Blue-brown.	9·32	10·4	10·4	+137·5	.....	Wheat starch, much broken, with much fibrous tissue.
2·30	1·51	0·17					18·3				
2·40	1·52	0·16					14·3				
3·90	1·63	0·25	1·0128	33·00	Brown	9·04	16·1	9·3	+250·0	+200·0	Proteids (from mean total nitrogen × 6·25) = 9·88 p.c.
						9·36	20·4	13·6			
						9·20	18·2	11·4			
3·15	1·58	0·21	1·0127	30·88	.. ..	9·26	16·2	10·9	+194·0	+200·0	Calorific value = 3840·3 calories per gram.

GRAPE

Date of Collection.	Description of Sample by Food Inspector.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher.	Serial Number.	Designation Number.	Moisture. Loss of weight at 110° in coal gas.	Fat. Petroleum ether extractive.	Ash.
1902.						p. c.	p. c.	p. c.
July 29	Grape Nuts. ...	J. T. Macdonald, Calgary.	Postum Cereal Co., Ltd., Battle Creek, Mich.	18	21704	...	...	....
" 21	Cereal Breakfast ..	Edward Flaherty, Stratford.	" ..	19	22034*a*	9·5	0·55	1·64
" 21	" ..	" ..	" ..	20	22034*b*	9·4 9·3	0·61 0·62	....
						9·35	0·615	
					Means.	9·43	0·58	1·64

LIFE

" 24	Life Chips.....	Wallbridge & Clark, Belleville, Ont.	Health Food Co., London, Ont.	21	21230	.....	....	2·82
" 24	" ..	" ..	" ..	22	Special.	9·9 9·9	1·69	2·38
						9·9		
					Means.	9·9	1·69	2·60

RALSTON BREAK

Aug. 7	Ralston's Breakfast Food.	Shaw Bros., Windsor, N. S.	Robinson Danforth Milling Co., Purina Mills, St. Louis	23	20230	12·50 12·14	1·42	0·70
						12·32		
July 30	Breakfast Food...	F. Filion, Vancouver, B. C.	Purina Mills, St. Louis.	24	21684	13·64 13 80	1·65	0·86
						13·72		
						13·02	1·54	0·78

* Precipitate by alcohol from water extract.

NUTS.

Crude Fibre.	Nitrogen. Total.	Nitrogen. Soluble.	Cold water extractive. Density of 10 p. c. Solution.	Cold water extractive. Solids dry at 100° C.	Cold water extractive. Iodine reaction.	Cold water extractive. Dextrine.*	Cold water extractive. Substances reducing Fehling Solution. Cu_2O per 100 grammes. Before inversion.	Cold water extractive. Substances reducing Fehling Solution. Cu_2O per 100 grammes. After inversion.	Cold water extractive. Rotation in 2dm. tube per 100 grammes. Before inversion.	Cold water extractive. Rotation in 2dm. tube per 100 grammes. After inversion.	Remarks.
p. c.	p. c.	p. c.		p. c.			p. c.	p. c.			
. .	.	. .	. .		. . . . .	. . .		. . . .	. . . . .		This sample did not come to hand.
2·60	1·89	0·29	1·0202	50·6	Brown	24·92	26·4	18·1	+ 300·0	. . .	Calorific power (mean) = 3968·9 calories per gramme.
	1·91	0·31	1·0189				25·4	17·4	+ 280·0		
	1·90	0·30	1·0196				25·9	17·8	+ 290·0		Wheat starch; granules much broken; fibrous tissues.
1·46	1·93	0·29	1·0202	48·1	„	24·76	21·5	16·0	+ 275·0 + 240·0		
		0·30	1·0201	48·7		24·88	21·7	15·5	+ 350·0 + 300·0		Proteids (mean total nitrogen × 6·25) = 12·00 per cent.
		0·30	1·0202	48·4		24·82	21·6	15·7	+ 312·0 + 270·0		
2·03	1·92	0·30	1·0199	49·5		24·87	23·8	16·8	+ 301·0 + 270·0		Direct estimation of unchanged starch gave 32·50 per cent.

CHIPS.

. . . .	1·51	0·25		19·3	. . . . .		9·85	8·50	+ 140·0 + 106·6		Calorific value (mean) = 3925·9 calories per gramme.
2·90	1·59	0·19	1·0091	. . .	. . . . .	12·16	. . .	. . . . .			Broken starch granules. Much husk tissue.
			1·0084								
			1·0087								Proteids (mean total nitrogen × 6·25) = 9·69 per cent.
2·90	1·55	0·22	1·0087	19·3	. . . . .	12·16	9·85	8·50	+ 140·0 + 106·6		Direct estimation of unchanged starch gave 43·10 per cent.

FAST FOOD.

. . . . .	2·29	0·26	1·0038	7·0	. . . . .	3·32	. . . . .	. . . . .			Starch granules, mostly entire. Wheat, and many small granules; rice.
1·64	1·67	0·25	1·0031	8·0	None.	1·92	0·0	0·0	0	0	Proteids (mean total nitrogen × 6·25) = 12·50 per cent.
1·72	1·74		1·0033								
1·68	1·70		1·0032								
1·68	2·00	0·26	1·0035	7·5	. . . .	2·62	0·0	0·0	0	0	Calorific value = 3911·7 calories per gramme.

ROLLED

Date of Collection.	Description of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher.	Serial Number.	Designation Number.	Moisture. Loss of weight at 110° C. in cereal gas.	Fat. Petroleum ether extractive.	Ash.
1902.						p. c.	p. c.	p. c.
July 22	Rolled oats.. ..	J. E. B. Campeau, Stanstead, Que.	The Ogilvy Milling Co., Montreal.	25	23333 (*a*)	10·45	.....	1·68
" 22	"	" ..	" ..	26	23333 (*b*)	11·82 12·12	7·11 7·31	..
						11·97	7·21	
					Means..	11·21	7·21	1·68
" 22	Rolled oats...	.....	.....	27	Special.	10·84	6 91	1 14
" 22	"	.....	.....	28	"	10·40	1·33	2·62
" 22	"	.....	.....	29	"	13·12	5·21	1·42
" 22	"	.....	.....	30	"	14·90	2·01	0·58

TABULATION OF

Malt Breakfast Food	9·99	1·03	0·56
Force	11·92	1·27	2·75
Malta Vita	11·10	1·25	3·00
Grape Nuts	9·43	0·58	1·64
Life Chips	9·90	1·69	2·60
Ralston Breakfast Food	13·02	1·54	0·78
Rolled Oats	11 21	7·21	1 68
Oatmeal	10·84	6·91	1·14
Peameal	10·40	1·33	2·62
Common Cornmeal	13·12	5·21	1 42
Golden Cornmeal	14 90	2·01	0·58

Calorific value per 1 gramme—

For Oatmeal	4270·6 calories.
Peameal	4132·7 "
Cornmeal (Common)	4029·2 "
" (Golden)	3804 3 "

*Precipitate by alcohol from water extract.

OATS.

Crude Fiber.	Nitrogen.		Cold Water Extractive.								Remarks.
	Total.	Soluble.	Density of 10 p.c. solution.	Solids dry at 100° C.	Iodine reaction.	Dextrine.	Substances reducing Fehling Solution Cu_2O per 100 grms.		Rotation in 2 dm. tube, per 100 grms.		
							Before inversion.	After inversion.	Before inversion.	After inversion.	
p. c.	p. c.	p. c.		p. c.		p. c.	p. c.	p. c.			
3·14	2·10	0·11	1·0024	6·0	None.	3·52	0	0	0°	0	Oat starch and fibre.
		0·13	1·0023			2·48					
		0·12	1·0024			3·00					
....	1·96	0·16	1·0027	6·95	None	3·44	0	0	0°	0	*Proteids* (mean total nitrogen ·6·25 = 12·69 per cent calorific value = 4242·2 calories per gramme.
		0·09	1·0023	5·80		4·88					
		0·13	1·0025	6·38		4·16					
3·14	2·03	0·13	1·0025	6·19	....	3·58	0	0	0	0	
....	2·08	0·18	1·0020	.....	None.	....	0	0	0	0	Granulated oatmeal.
....	4·41	1·19	1·0076	.	"		0	0	2·5	0	Peameal.
....	1·64	0·26	1·0035	....	"	..	0	0	0	0	Common cornmeal.
..	1·43	0·07	1·0019	....	"	.....	0	0	.....	0	Golden cornmeal.

MEAN RESULTS.

1·05	1·99	0·18	1·0051	13·00	None to brown.	3·24	7·29	7·55	54·7	53·6	Malt Breakfast Food.
2·60	1·85	0·21	1·0129	29·60	Blue or brown.	14·48	7·00	7·45	122·7°	108·5°	Force.
3·15	1·58	0·21	1·0127	30·88	Blue or brown.	9·26	16·20	10·90	194·0	200·0	Malta Vita.
2·03	1·92	0·30	1·0199	49·50	Brown.	24·87	23·80	16·80	301·0	270·0°	Grape Nuts.
2·90	1·55	0·22	1·0087	19·30	Blue.	12·16	9·85	8·50	140·0	106·6	Life Chips.
1·68	2·00	0·26	1·0035	7·50	None.	2·62	0·0	0·0	0	0	Ralston Breakfast Food.
3·14	2·03	0·13	1·0025	6·19	"	3·58	0·0	0·0	0	0	Rolled Oats.
4·28	2·08	0·18	1·0020	3·83	"	....	0·0	0·0	0	0	Oatmeal.
1·36	4·41	1·19	1·0076	17·75	"	....	0·0	0·0	2·5	0	Peameal.
3·50	1·64	0·26	1·0035	6·30	"	....	0·0	0·0	0·0	0°	Common Cornmeal.
1·18	1·43	0·07	1·0019	2·90	"	....	0·0	0·0	.....	0	Golden Cornmeal.

Proteids (total nitrogen × 6·25)—
For Oatmeal = 13·00 per cent.
Peameal = 27·56 per cent.
Cornmeal (Common) = 10·25 per cent.
" (Golden) = 8·94 per cent.

CENTRIFUGAL APPARATUS FOR QUANTITATIVE ANALYSIS.

A piece of apparatus is described by F. Steimtzer in the Zeit. für Analyt. Chem., 1902, 100 (Abst. in Jour. Soc. Chem. Indust., 1903, 562).

The apparatus illustrated on page 31, was designed by me, and worked out with the assistance of Mr. Thornton, machinist, of this city. It has been in continuous use in my laboratory for five years, and has given perfect satisfaction.

It is driven at a rate of 1,500—3,000 revolutions per minute by an electromotor of one and a-half H.P. driving a countershaft from a main shaft and by a half crossed belt (d^1).

It consists of a heavy iron base plate (a), Figs. 1, 2, 3, 23 inches diameter and $1\frac{3}{4}$ inches high. Three iron pillars, 15 inches high, support a three armed head-piece (b), and between these two is journaled in bearings (a^1) the steel shaft (c), with driving pulley (d). This shaft works on a ball bearing (e) at the lower end (Fig. 3) and on a steel point (f) at the upper end. It carries a yoke (g), shown in detail in Figs. 3 and 4. This yoke supports two steel rings pivoted on steel bearings, into which rings slip easily, the tube supports of copper (h, h^1) which are of two shapes according as tubes of the form k, l or m are used. In Fig. 3 the two different supports are shown in position. These tube supports are of equal weight, so as to be interchangeable. At the bottom of each tube support is slipped a piece of rubber, being an ordinary rubber cork when (h^1) is used and the half of a rubber ball (h^0) perforated in the centre when (h) is used. The glass tubes (l) and (k) are ordinary, thick walled, test tubes, and must be well annealed. The various operations of precipitation, extraction, washing, &c., are performed in these tubes, the latter operation being done by decantation, after shaking (an operation greatly facilitated by a specially constructed shaking machine. The precipitate is usually packed down so firmly in the bottom of the tube after 5—10 minutes centrifuging, that the wash water can be poured off to the last drop or two. The tube (m) is a specially constructed separating funnel (about 175 cc. capacity) of such a form as to fit the tube support. The most troublesome emulsions are easily separated by the centrifuge.

In Fig. 1 is shown a cover (n) made of $\frac{1}{8}$ inch steel plate, capable of being pulled down over the machine when in use as a safety protection. This is counterpoised by a weight (shown at (p) in Fig. 2), suspended on a cord running over friction pulleys which are supported by the top frame. The cover is running on guide rods (q) in guides (r). The tubes (k) hold about 30 cc. and are naturally preferred when sufficiently large for the work in hand. Tubes (l) hold about 125 cc.

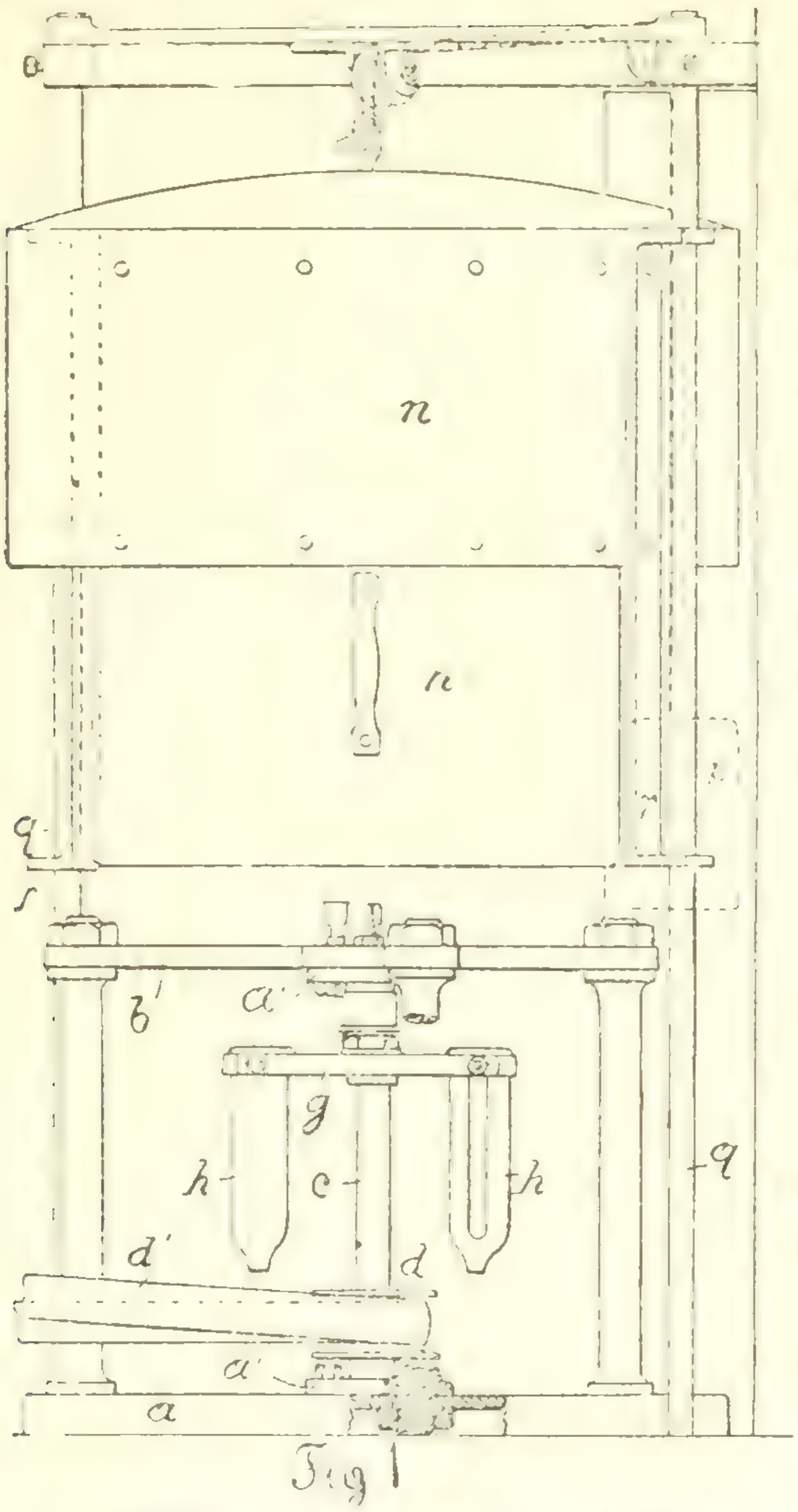

Fig 1

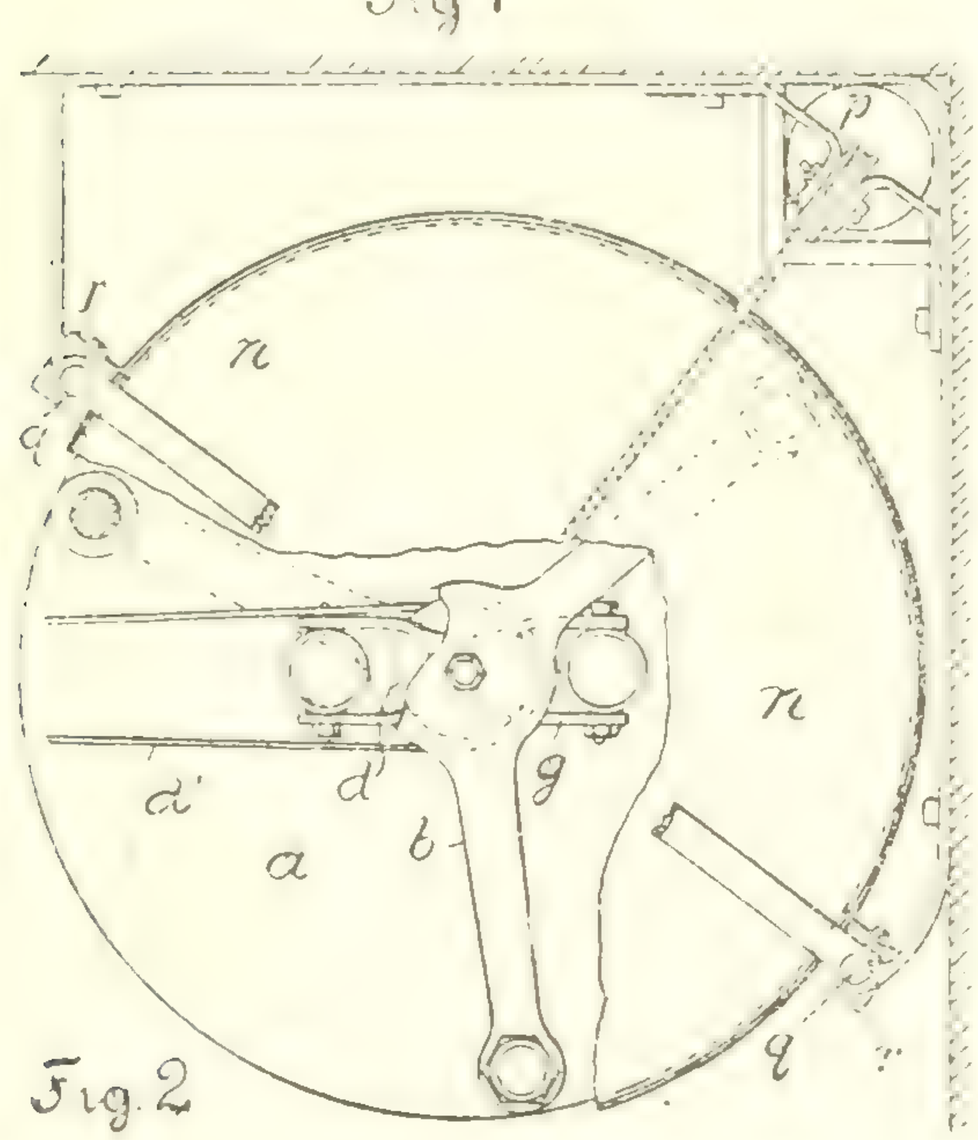

Fig. 2

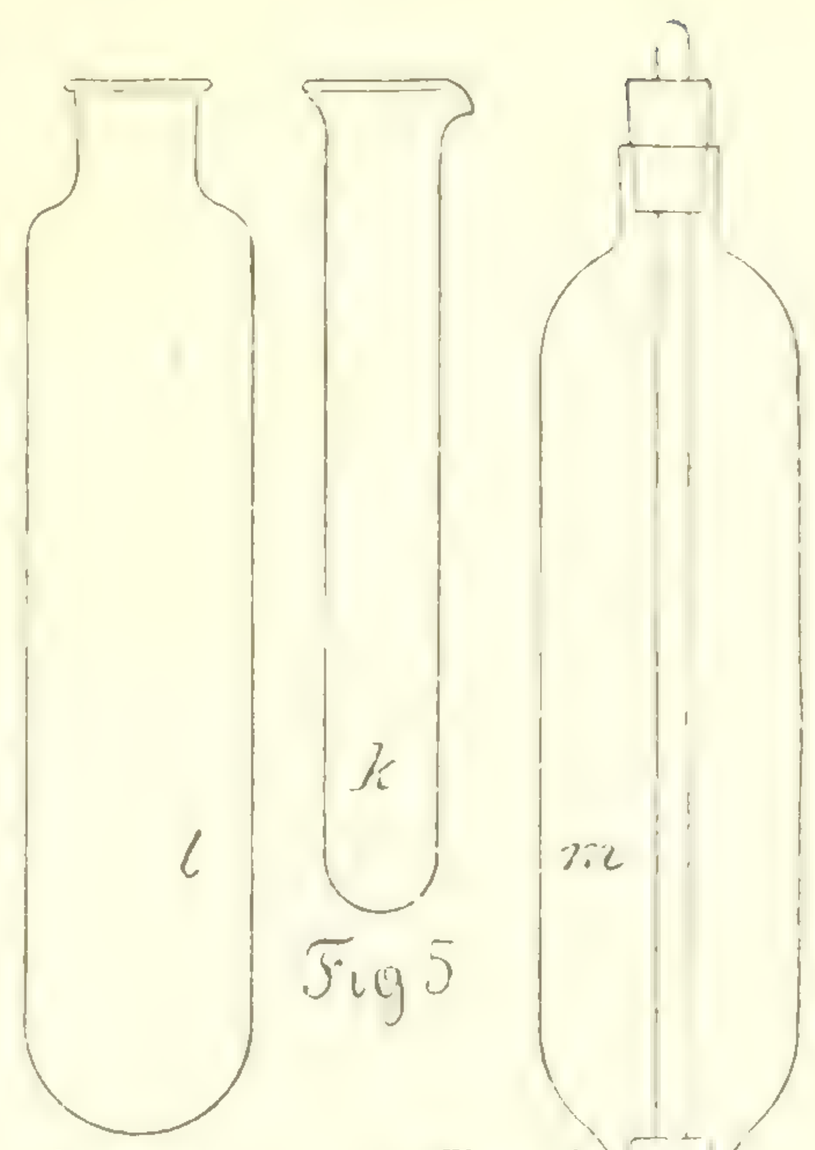

Fig 5

Fig 6

Fig 7

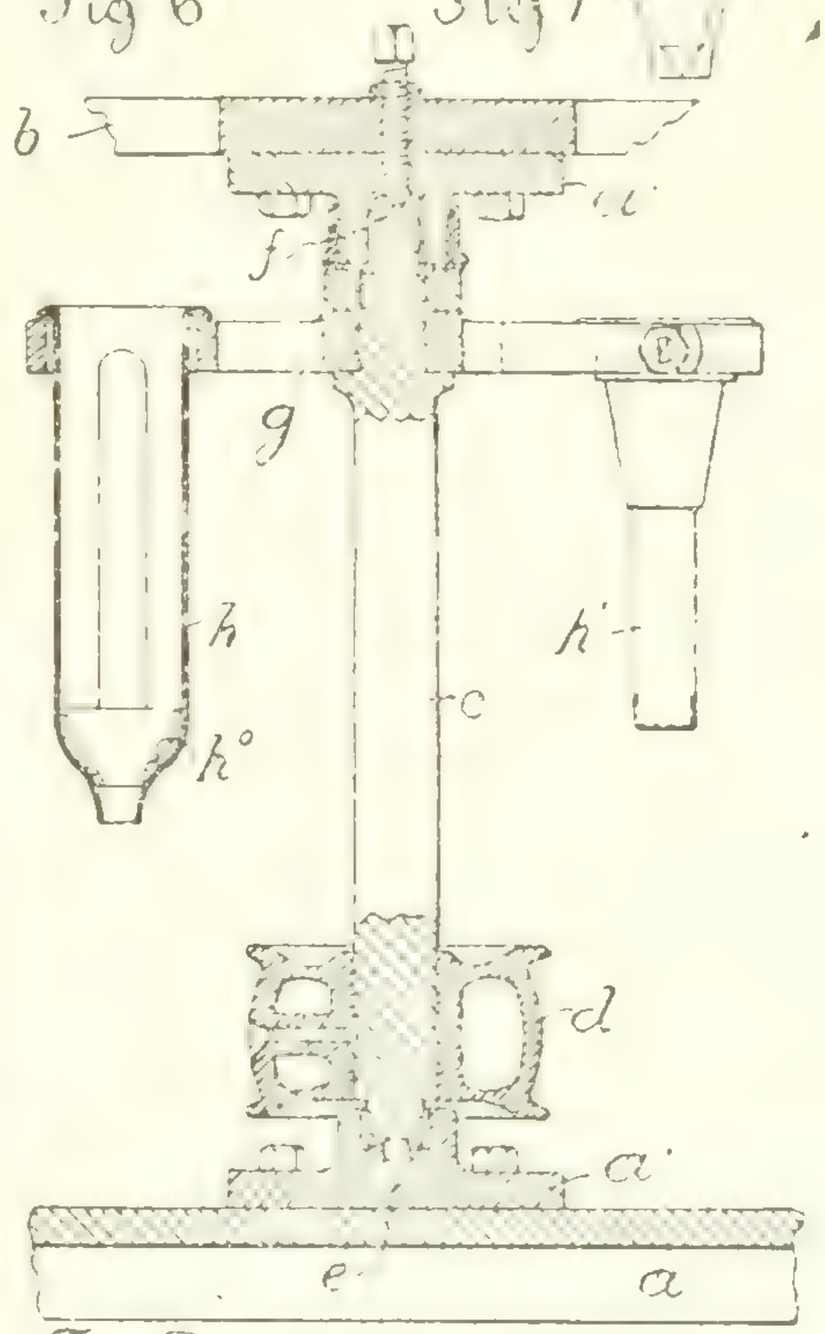

Fig. 3

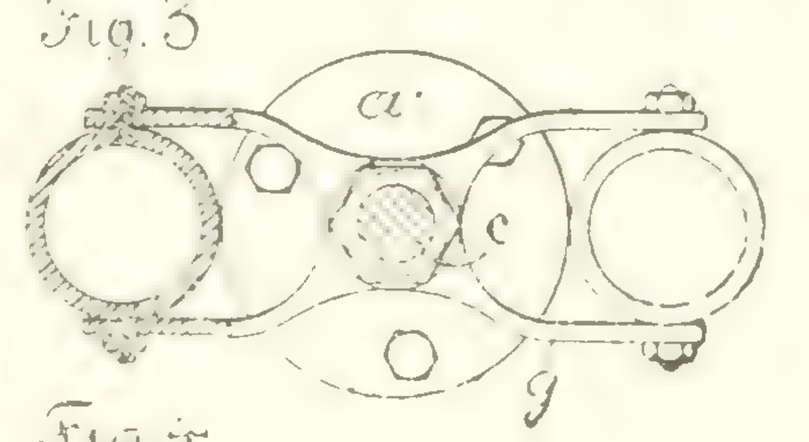

Fig 4

APPENDIX D.

BULLETIN No. 85.—CANNED MEATS.

OTTAWA, June 10, 1903.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR, —I have to transmit, herewith inclosed, a report by Mr. McGill on the samples of canned meats which were collected in accordance with your instructions of March 27 last. The report is accompanied by a table showing the source of the samples.

I have the honour to be, sir,

Your obedient servant,

THOMAS MACFARLANE,
Chief Analyst.

LABORATORY OF THE INLAND REVENUE DEPARTMENT,
OTTAWA, June 9, 1903.

THOS. MACFARLANE, Esq., F.R.S.C.,
Chief Analyst, Inland Revenue Department.

SIR,—I beg to hand you herewith a report on 99 samples of canned meats.

In two (2) of these samples the meat was quite spoiled; in three (3) others it was slightly spoiled. The remaining ninety-four (94) samples were in good condition.

It is worthy of note that one of the slightly spoiled samples contained boric acid. This fact may imply that the meat was not in good condition when put up; but it would be going too far to hold this as proved.

With this exception, all samples containing preservatives, were found to be in good condition.

All samples have been examined for preservatives. The only preservative found is boric acid, probably added in part as borax.

This has been found in twenty-one (21) samples, as follows:—

	Samples.
Chicken	4
Turkey	1
Wild duck	1
Pâté de foie gras	1
Tongue	3
Ham	3
Chicken, ham and tongue	1
Canned beef	3
Smoked "	2
Pigs feet	1
Brawn	1
Total	21

These represent the products of the following manufacturers, viz :—

W. Clark & Co., Montreal.
Canadian Packing Co., London.
Laing Packing Co., Montreal.
Beardsley & Sons, New York.

In no case has the quantity of boric acid found exceeded the limit fixed by the British Parliamentary Commission, viz :—0·5 per cent—and in most cases it has fallen markedly below this amount.

I have the honour to be, sir,

Your obedient servant,

A. McGILL.

Date of Collection.	Nature of Sample.	No. of Sample.	Name and Address of Vendor.	Quantity.	Cost.	Name and Address of Manufacturer or Furnisher.	Preservatives.	Remarks.
1903.			*District of Halifax, &c.*		$ cts			
April 16	Canned beef	20238	F. H. Barteau, Yarmouth, N.S.	3 bots.	0 40	Laing Packing Co., Montreal	None	Good condition.
" 16	" tongue	20253	Murphy & Demont, Windsor, N.S.	3 cans	0 36	Clark & Co., Montreal	Boric acid, less than 0·5 p. c.	"
" 20	" ham	20256	Shand Bros., Windsor, N.S.	3 "	0 30	Libby, McNeil & Libby, Chicago.	None	"
" 20	" turkey	20257	Wentforth Stores, Windsor, N.S.	3 "	0 30	" "	"	"
" 27	Potted ham	20307	R. T. Forristall, Halifax, N.S.	3 "	0 30	" "	"	"
" 27	" tongue	20310	R. Urquhart & Son, Halifax, N.S.	3 "	0 30	" "	"	"
" 27	Canned chicken	20311	W. J. Hopgood, Halifax, N.S.	3 "	0 30	W. Clark, Montreal	Boric acid, less than 0·5 p. c.	"
" 30	Corned beef	20317	Jas. Scott & Co., Halifax, N.S	3 "	0 45	"	None	"
" 30	Potted ham	20318	H. W. Wentzell, Halifax, N.S.	3 "	0 18	Wm. Davis, Toronto	"	Meat was very badly decomposed.
" 30	" tongue	20319	" "	3 "	0 21	Libby, McNeil & Libby, Chicago.	"	Good condition.
" 17	Corned beef	4319	Geo. Rackham, Charlottetown	3 "	0 60		"	"
" 17	Pigs feet	4323	L. MacNutt, Charlottetown	3 "	0 25	B.& M. Rattenberg, Charlottetown	"	"
" 17	Corned beef	4324	" "	3 "	0 60		"	"
" 23	Roast mutton	4342	Beck & Goff, Charlottetown	3 "	0 84		"	"
" 20	Chicken	4331	Brace, McKay & Co., Summerside	3 "	0 60		"	"
			District of New Brunswick.					
" 11	Canned beef	17859	L. E. Worden, 73 Sydney St., St. John.	3 cans	0 48	W. Clark, Montreal	None	Good condition.
" 13	" ham	17860	Wm. Baxter, 71 Pitt St., St. John.	3 "	0 60	Libby, McNeil & Libby, Chicago.	"	"
" 14	Lunch tongue	17871	Baird & Peters, 16 20 Ward St., St. John.	3 "	0 66	Packed in Canada for Baird & Peters	"	"
" 16	Sliced bacon	17878	W. B. McKay & Co., Main St., Sussex	3 "	0 57	Libby, McNeil & Libby, Chicago.	"	"
" 17	Beef loaf	17883	W. G. Bell, 314 Main St., Moncton	3 "	0 75	" "	"	"
" 17	Veal loaf	17892	A. K. McLean & Co., 293 Main St., Moncton	3 "	0 45	" "	"	"
" 17	Lunch tongue	17898	Hugh McKenna, King St., St. Stephen	3 "	0 90	B.& M. Rattenberg, Charlottetown	"	"
" 23	"	17907	John Graham, Queen St., Woodstock	3 "	0 90	Wm. Davies Co., Toronto	"	Meat was slightly discoloured.
" 23	Lamb's tongue	17911	Noble & Trafton, 64 Main St., Woodstock.	3 "	0 75	" "	"	Good condition.
" 25	Jellied hocks	17913	M. R. Logan, Queen St., Fredericton	3 "	0 90	Libby, McNeil & Libby, Chicago.	"	"

			District of Quebec.							
April 17	Chicken, ham and tongue	23342	H. Robert, St. Hyacinthe	3	cans	0	36	Wm. Clark, Montreal	None	Good condition.
" 20	Canned beef	23345	H. Bisaillon, St. Lambert	3	"	0	60	Armour Packing Co., Kansas City	"	"
" 21	Cooked tongue	23355	Gerard et Corbiere, Lacolle	3	"	1	00	Wm. Clark, Montreal	"	"
" 21	Cooked beef	23356	" "	3	"	0	45	"	"	"
21	Boneless turkey	23357	" "	3	"	0	75	Simcoe Canning Co., Simcoe	"	"
" 29	Canned meat	23376	L. F. Denechaud, Three Rivers	3	"	0	45	Libby, McNeil & Libby, Chicago	"	"
" 29	"	23377	" "	3	"	0	45	" "	"	"
May 1	Pâté de foie	23386	J. E. Pichette, Joliette	3	"	0	45	Canadian Pkg. Co., London, Ont.	Boric acid	"
" 7	Pigs feet	23394	Victor Gervais, St. Hyacinthe	3	"	0	45	Libby, McNeil & Libby, Chicago	None	"
			District of Montreal.							
April 25	Corned beef	21274	A. Archambault, 2045 St. James St., St. Henri	3	tins	0	45	Wm. Clark, Montreal	None	Good condition.
" 25	Pâté de foie gras	21275	Z. Trudeau, 3571 N. Dame St., St. Henri	3	"	0	30	A. Groll, Montreal	"	"
" 25	Devilled chicken	21276	" " "	3	"	0	30	W. Clark, Montreal	Boric acid	"
" 29	Potted turkey	21277	Laing Packing Co., Montreal	3	"	0	30	Vendors	"	"
" 29	Corned beef	21278	" "	3	"	0	37	"	None	Meat quite spoiled.
" 29	English brawn	21279	" "	3	"	0	38	"	"	Good condition.
May 8	Pigs feet	21280	E. Limoges, 1949 N. Dame St., Montreal	3	"	0	45	W. Clark, Montreal	Boric acid	"
" 8	Beef	21281	L. P. Lavoie, 3187 N. Dame St., Montreal	3	"	0	30	Libby, McNeil & Libby, Chicago	None	"
" 8	Ham	21282	" " "	3	"	0	30	" "	"	"
" 8	Lunch beef	21283	W. J. Maloney, 468 St. Antoine St., St. Cunegonde	3	"	0	50	W. Clark, Montreal	Boric acid	"
			District of Toronto.							
April 15	Tongue	23421	R. English, 490 Yonge St., Toronto	3	tins	0	15	W. Clark, Montreal	Boric acid	Good condition.
" 15	Ham	23422	" " "	3	"	0	15	" "	"	"
" 15	Potted ham	23423	Wm. Davies Co., Ltd., 444 Yonge St., Toronto	3	"	0	30	Vendors	None	"
" 15	Potted beef	23424	" " "	3	"	0	30	"	"	"
" 15	Corned beef	23425	" " "	3	"	0	30	"	"	Meat slightly discoloured.
April 16	Chicken	23426	J. M. Bothwell, Dunlop St., Barrie	3	"	0	23	W. Clark, Montreal	Boric acid	Good condition.
" 16	Beef loaf	23427	" "	3	"	0	45	Libby, McNeil & Libby, Chicago	None	"
" 16	Chicken, ham and tongue	23428	James Vair "	3	"	0	38	W. Clark, Montreal	Boric acid	"
" 16	Ham loaf	23429	Hobbley Bros. "	3	"	0	45	Libby, McNeil & Libby, Chicago	None	"
" 17	Potted beef	23430	John V. Carpenter, Market Sq., Hamilton	3	"	0	15	Armour & Co.	"	"
			District of Kingston.							
April 29	Wild duck	23118	H. T. Hamly, Walton St., Port Hope	3	tins	0	15	W. Clark, Montreal	Boric acid	Good condition.
" 20	Potted tongue	23119	" " "	3	"	0	30	Wm. Davies Co., Toronto	None	"
" 20	Potted ham	23120	" " "	3	"	0	30	" "	"	"
" 22	Ox tongue	23121	Jas. Mayberry & Co., Prescott, Ont	3	"	0	45	Armour & Co	"	"
" 22	Sausage	23122	" "	3	"	0	45	"	"	"

Date of Collection.	Nature of Sample	No. of Sample.	Name and Address of Vendor.	Quantity.	Cost.	Name and Address of Manufacturer or Furnisher.	Preservatives.	Remarks.
1903.			*District of Kingston.*		$ cts.			
April 22	Boned chicken ...	23123	R. McGregor, Sparks St., Ottawa....	3 tins.	0 75	Aylmer Canning Co.	None	Good condition.
" 22	Strausberg meat ..	23124	" " "	3 "	0 30	A. Defourier Co., Ltd., London..	"	"
" 30	Corned beef.	23125	G. W. Runions, Marlboro St., Cornwall.	3 "	0 45	Laing Packing Co., Montreal....	"	"
" 20	Veal loaf	23116	W. H. Hamilton, Simcoe St., Peterboro.	3 "	0 45	Libby, McNeil & Libby, Chicago.	"	"
" 20	Smoked beef.....	23136	E. Brown & Co., George St. "	3 "	0 60	W. Clark, Montreal.	Boric acid.....	"
			District of London.					
April 9	Canned beef...	22044	J. W. Irwin, Clinton, Ont	3 tins.	0 45	W. Clark, Montreal.....	Boric acid ...	Good condition.
" 9	" "	22046	Sturdy & Co., Goderich	3 "	0 45	Laing Packing Co., Montreal....	None.....	"
" 13	Potted ham. ..	22050	J. C. Jones, Stratford, Ont	3 "	0 30	Libby, McNeil & Libby.....	"	"
" 13	Potted tongue	22051	W. W. Hill, Mitchell, Ont.....	3 "	0 15	W. Clark, Montreal.....	Boric acid.....	"
" 13	Ham loaf.....	22053	W. R. Cole "	3 "	0 45	Libby, McNeil & Libby, Chicago.	None. ...	"
" 13	Veal loaf	22054	" "	3 "	0 45	" " ..	"	"
" 15	Canned meat	22059	Andrew Young, Seaforth	3 "	0 37	W. Clark, Montreal.	Boric acid	"
" 15	" chicken.	22060	Peter Dill "	3 "	0 30	"	"	"
" 16	" beef.....	22062	Beck & Schell, Berlin.	3 "	0 45	"	None.....	"
" 16	" sausage...	22063	" "	3 "	0 45	Libby, McNeil & Libby, Chicago.	"	"
" 16	" tongue ...	22064	" "	3 "	0 15	Armour & Co., Chicago.....	"	"
			District of Winnipeg.					
April 15	Corned beef	17428	B. Tobias Co., Morden..	1 lb.	0 60	Wm. Clark, Montreal.....	None. ...	Good condition.
" 15	Lunch tongue.....	17432	T. E. McGirr Co., Morden..	1 "	1 05	"	"	"
" 16	Boneless chicken..	17434	S. Shannon Co., Ltd., Killarney.....		0 90	Lalor Canning Co., Dunnville, Ont	"	"
" 17	Sausages.....	17435	Hudson Bay Co., Deloraine.....		0 60	W. Clark, Montreal.....	"	"
" 17	Sliced smoked beef	17436	Hudson Bay Co., Deloraine.....		1 05	Beardsley & Sons, New York....	Boric acid ..	"
" 20	Veal loaf.	17441	Hamelin Bros., Melita	3 cans	0 60	German American Prov. Co....	None.....	"
" 20	English brawn ...	17442	I. McJannett, Melita.....	3 "	1 00	Wm. Clark, Montreal.....	Boric acid.....	"
" 21	Ham loaf.....	17445	W. J. Wilson, Virden.....	3 "	0 90	Libby, McNeil & Libby, Chicago.	None.	"
" 24	Sliced bacon	17456	G. Kennedy, Carberry	3 "	1 05	" "	"	"
" 25	Head cheese.....	17457	T. A. Garland, Portage la Prairie.....	3 "	0 75	" "	"	"

District of Manitoba.

April	21	Corned beef	21713	Phillips Bros., Red Deer	3	tins	0 75	W. Clark, Montreal	None	Good condition.
"	23	Pigs' feet	21717	N. W. Gould, Wetaskiwin	3	"	1 00	Aylmer Canning Co	"	"
"	24	Lunch tongue	21722	McDougall & Secord, Edmonton	3	"	1 00	W. Clark, Montreal	"	"
"	25	Canned ham	21725	McLaren, Strathcona	3	"	0 75	" "	Boric acid	Meat slightly discoloured.
"	29	Corned beef	21728	E. Mathews, Calgary	3	"	0 60	" "	None	Good condition.

District of British Columbia.

"	16	Mutton	21687	A. T. Charleton, Port Haney	2	cans	0 35	W. Davies Co., Toronto	"	"
"	16	Devilled ham	21693	H. Alder, Mt. Lehman, B.C.	2	"	0 25	W. Clark, Montreal	Boric acid	"
"	17	Corned beef	21697	H. C. Henderson, Chilliwack	2	"	0 40	Lang Pkg. Co., Montreal	None	"
"	17	"	23502	G. R. Ashwell Sons, Chilliwack	2	"	0 40	Davies & Son, Toronto	"	"
"	17	Lunch tongue	23504	Mrs. E. A. Farrer, Chilliwack	2	"	0 35	Aylmer Canning Co	"	"
"	17	Veal loaf	23507	The Harrison River Mills Timber and Trading Co., B.C.	3	"	0 60	Libby, McNeil & Libby	"	"
"	18	Lunch tongue	23511	M. Desbrisay & Co., Mission, B.C.	3	"	0 90	Canadian Pkg. Co., London, Ont.	"	"
"	18	Devilled ham	23514	J. Plumridge, Mission, B.C.	3	"	0 45	Armour & Co., Chicago	"	"
"	18	Lunch tongue	23517	S. Petersky, Steveston, B.C.	2	"	0 70	Simcoe Canning Co.	"	"
"	21	Potted beef	23521	E. Hunt, Steveston	3	"	0 30	C. & E. Morton, London	"	"

APPENDIX E.

BULLETIN No. 86.—FERTILIZERS, 1903.

OTTAWA, June 21, 1903.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR,—I submit herewith a tabulated statement, marked Table I., containing a description of 128 standard samples of agricultural fertilizers, which were sent in to the Department of Inland Revenue by their manufacturers, importers or vendors, in accordance with the provisions of the Fertilizers Act, 1890, and as representing the goods which it was proposed to offer for sale in Canada during the season, 1903–4. There is a slight increase in the number of standard samples this year compared with the three preceding seasons, as will be evident from the following statement :—

In	1897	there	were	107	standard samples submitted.
	1898	"		124	" " "
	1899	"		154	" " "
	1900	"		107	" " "
	1901	"		102	" " "
	1902	"		106	" " "
	1903	"		128	" " "

Table I. gives the designations of the various brands of fertilizers, the names of the manufacturers, the claims made as regards their contents in fertilizing ingredients, and the actual quantities of these found in the standard samples on analysis in this laboratory. The guaranteed contents are given in the upper line, and the analytical results in the second line placed opposite the designation of the fertilizer. In many cases the claims made are imperfect and indefinite, and, in some, the requirements of the Act calling for a certificate of analysis, and a statement of the materials used in the manufacture of the fertilizer have been neglected. With regard to indefinite claims it may be mentioned that these are often made by reputable makers, when a particular fertilizer is described as containing say 'from 2.5 to 3.0 p.c. of ammonia,' or 'from 8 to 9 of available phosphoric acid,' or 'from 9.5 to 11.0 p.c. of potash.' In such instances if an ingredient is found deficient, and the sample is challenged, the manufacturer often defends himself by maintaining that his guarantee does not extend above the lowest of the figures mentioned. For this reason the 'guaranteed contents' of a fertilizer, as stated in Table I, must be understood to indicate only the lowest percentage given in the manufacturers' label, or in his communications to the department.

As required by the Fertilizer Act, Table I. also contains a column in which 'the relative value of each fertilizer calculated from the contents in fertilizing ingredients' is given, the prices of these ingredients being as follows :—

	Cents Per Lb.
Nitrogen in salts of ammonia or nitrates, as well as in compound fertilizers	13
Organic nitrogen in ground bone, fish, blood or tankage	12
Phosphoric acid :—	
Soluble, in water	6
Soluble, in 1 p.c. citric acid	$5\frac{1}{5}$
Insoluble in Thomas phosphate powder	$3\frac{1}{5}$
Insoluble, in ground rock phosphate and fertilizers generally	$1\frac{1}{2}$
Potash, contained in wood ashes	6
Potash from high grade salts	$5\frac{1}{4}$

The valuation of each brand is calculated on the results of the analysis of the standard samples, but it has been omitted in the case of the guaranteed contents on account of the imperfect character of the information supplied in the majority of cases.

I have also to submit a description of the fertilizer samples which were collected, as sold in the open market, in accordance with the instructions received from you on 27th March last. This description is called Table II, and contains the date of collecting the samples, the names of the vendors and manufacturers, the designation of the brand, and the results of the analyses. The figures obtained in examining the sample as sold are given in the third line following the name of the fertilizer, and on the second will be found the analysis of the corresponding standard sample, as well as its valuation. In cases where no standard samples have been sent in to the department and, nevertheless, in contravention of the Fertilizer Act, the fertilizers have been offered for sale it has of course not been found possible to give either the guaranteed contents or the analysis of a standard sample. The number of such fertilizers not registered and therefore illegally sold, amounts to ten, which is slightly less than in former years.

According to the opinions expressed by the analysts 9 out of the 84 samples collected as sold have been found to be adulterated, according to the Act, being deficient in available phosphoric acid or other fertilizing constituents, or have been indicated as being 'below guarantee.' It not unfrequently happens that the fertilizing constituents of the standard samples show higher percentages than claimed in the guarantee of the manufacturers. Nevertheless, the latter must be used by the analysts in judging of the genuineness of a sample, and where the figures of the guarantee are defective it becomes almost impossible to give an opinion. It is therefore very important that when standard samples are supplied by vendors or manufacturers, they should be accompanied by certificates of analysis, or at least by a statement of the lowest guaranteed percentages of every fertilizing constituent present.

It will be remembered that in my report of May 13, 1901, (Bulletin No. 75) the proceedings were fully detailed which led to an alteration in the method of determining the available phosphoric acid in fertilizers, the adoption of which was then authorized by the Commissioner of Inland Revenue, and has since been carried out in this laboratory and in those of the district analysts. Since many manufacturers in the United States still continue to mention, in their guarantees, a percentage of 'reverted' phosphoric acid, it seems necessary to state that in Canada a determination of 'citric soluble' phosphoric acid is made, and the determination of 'reverted' discontinued. It would also seem to be advisable to repeat here the details of the process adopted in Canada for ascertaining the percentage of 'available' phosphoric acid contained in agricultural fertilizers:—

Citric insoluble phosphoric acid.

(a) In acidulated samples—Introduce the filter containing the washed residue from the determination of soluble phosphoric acid in two grammes of the original sample into a flask with 100 cc of 1 per cent citric acid solution, stopper tightly and shake violently until the filter paper is reduced to a pulp. Add 100 cc additional of the 1 per cent citric acid solution and digest at room temperature for half an hour, shaking the flasks thoroughly every five minutes. With five analyses in hand this means an agitation of one minute duration repeated six times. Filter and wash thoroughly. Dry and transfer the filter and its contents to a crucible, ignite until all organic matter is destroyed, add from 10 to 15 cc of strong nitric or hydrochloric acid and digest until all phosphate is dissolved. Dilute the solution to 200 cc, mix well, filter through a dry filter and proceed as for the estimation of total phosphoric acid.

(b) In non-acidulated samples—In case a determination of citric insoluble phosphoric acid is required in non-acidulated samples, such as mineral phosphates basic slag, Thomas phosphate powder, ground bone, bone char or bone ash, it is to be made by taking two grammes of the phosphatic material (without previous washing with water) and introducing it into a flask with 100 cc of a 5 per cent solution of ammonium chloride and boiling it for forty minutes, replacing always the evaporated water, then filtering

and washing the residue and treating it, exactly as above described with 1 per cent citric acid solution, determining the phosphoric acid in the residue.

Citric Soluble Phosphoric Acid.—The sum of the water-soluble and the citric-insoluble phosphoric acid subtracted from the total contained in the fertilizer gives the citric-soluble phosphoric acid.

The sum of the latter and the water-soluble phosphoric acid is to be regarded as 'available phosphoric acid.'

I beg to recommend the publication of this report, together with Tables I and II, as well as the 'Memoranda on Manures,' which it has been customary to print at the same time.

I have the honour to be, sir,

Your obedient servant,

THOMAS MACFARLANE,

Chief Analyst.

STANDARD SAMPLES OF COMMERCIAL FERTILIZERS

TABLE I.—Statement of the results of examining 128

Number of Sample.	Designation.	Name of Manufacturer.	By whom sent.	From what Materials Produced.	----
1363	Great Eastern Grass and Oats Fertilizer.	American Agricultural Chemical Co.	Great Eastern Fertilizer Branch. Rutland, Vermont.	. . . . .	Guaranteed contents Standard sample....
1364	Great Eastern Northern Corn Special Fertilizer.	"	"	. . . . .	Guaranteed contents Standard sample ...
1365	Great Eastern General Fertilizer.	"	"	. . . . .	Guaranteed contents Standard sample....
1366	Great Eastern Potatoe Manure Fertilizer.	"	"	. . . . .	Guaranteed contents Standard sample. ..
1367	Plain Superphosphate.	"	"	. . . . .	Guaranteed contents Standard sample. ..
1368	Essex Complete for Corn, Grain and Grass Fertilizer.	Russia Cement Co.	S. C. Shaffner, Granville Ferry, N.S.	. . . . .	Guaranteed contents Standard sample....
1369	Essex Complete for Potatoe, Roots and Vegetable.	"	"	. . . . .	Guaranteed contents Standard sample....
1370	Fish and Potash	"	"	. . . . .	Guaranteed contents Standard sample....
1371	Essex Orchard Fertilizer.	"	"	. . . . .	Guaranteed contents Standard sample....
1372	Essex Dry Ground Fish.	"	"	. . . . .	Guaranteed contents Standard sample....
1373	Essex Raw Bone...	"	"	. . . . .	Guaranteed contents Standard sample....
1374	Essex 'A 1' Superphosphate.	"	"	. . . . .	Guaranteed contents Standard sample ...
1375	Potatoe Phosphate. .	Provincial Chemical Fertilizer Co., St. John, N.B.	Manufacturers	. . . . .	Guaranteed contents Standard sample....
1376	Imperial Superphosphate.	"	"	. . . . .	Guaranteed contents Standard sample ...
1377	Fruit Tree Fertilizer	"	"	. . . . .	Guaranteed contents Standard sample....
1378	Victor Guano....	"	"	. . . . .	Guaranteed contents Standard sample....
1379	Bone Meal.....	"	"	. . . . .	Guaranteed contents Standard sample....
1380	Bone, Blood and Potash.	"	"	. . . . .	Guaranteed contents Standard sample....
1381	Exhibit 'B'	Wm. Davies Co., Limited, Toronto	"	Dried Blood, Bones and Tankage.	Guaranteed contents Standard sample...
1382	Exhibit 'A'.....	Harris Abattoir Co., Ltd.	Edward Adie, Secretary Treasurer, Toronto.	"	Guaranteed contents Standard sample....
1383	Capelton Superphosphate.	Nichols Chemical Co. of Canada, Ltd. Capelton, P.Q.	S. L. Spafford, Manager, Capelton, Que.	Canadian Apatite dissolved in Sulphuric Acid, Muriate of Potash, and Sulphate of Ammonia.	Guaranteed contents Standard sample....

SESSIONAL PAPER No. 14

Standard Samples of Commercial Fertilizers, registered for 1903

Results of Analysis.										
Nitrogen.		Phosphoric Acid.					Potash.	Moisture.	Relative value per ton of 2,000 lbs	Name of Analyst and Remarks.
Total including that of Nitric Acid and Ammonia.	Total calculated as Ammonia.	Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.				
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.	
		6·00		1·00	12·00	11·00				
0·77	0·93	11·19	0·00	2·88	14·07	11·19	6·24	10·90	21·04	Miss S. E. Wright.
	2·50	5·00		2·00	10·00	8·00	1·50			
1·95	2·36	8·15	0·33	3·51	11·99	8·48	1·80	12·40	18·15	
	1·00	5·00		1·00	10·00	8·00	4·00			
1·05	1·27	7·03	4·01	2·56	13·60	11·04	4·48	12·60	21·05	
	2·50	5·00		1·00	10·00	8·00	3·00			
1·90	2·31	7·99	2·07	3·21	13·27	10·06	2·99	13·60	20·87	
				1·00	15·00	14·00				
0·31	0·37	11·04	2·40	4·95	18·39	13·44		11·70	18·16	
	4·00	3·00		2·50	9·50	7·00	9·50			
2·58	3·13	6·72	2·40	2·23	11·35	9·12	10·50	3·60	35·17	Miss E. Davidson.
	4·50	3·00		2·00	9·00	7·00	9·00			
3·29	4·00	7·03	3·05	3·99	14·07	10·05	8·82	6·84	30·78	
	2·50	4·50		3·00	12·00	9·00	2·25			
2·18	2·67	5·60	5·11	4·15	14·86	10·71	4·16	9·72	23·18	
	2·00	4·00		3·00	9·00	8·00	8·50			
2·56	3·11	4·48	4·00	5·11	13·59	8·48	9·50	6·20	27·42	
8·00					11·00			8·00		
8·02	9·71	2·07	10·73	3·03	15·83	12·80	0·32	8·24	34·78	
3·50	4·00				18·00					
5·00	6·07		12·79	12·95	25·74	12·79		7·64	29·95	
	1·25				9·00	7·00	2·00			
1·00	1·32	3·36	6·88	4·31	14·55	10·24	3·28	4·56	19·16	
	3·75					8·00	6·50			
3·19	3·87	6·71	1·63	4·77	13·11	8·34	5·23	10·00	25·05	Miss S. E. Wright.
	3·00					10·50	1·50			
3·03	3·68	7·35	2·73	7·67	17·75	10·08	1·35	11·65	23·41	
	3·00					8·00	6·00			
3·02	3·67	8·15	1·48	4·60	14·23	9·63	3·35	10·80	26·00	
	2·00					7·60	2·50			
1·95	2·36	6·08	3·20	6·55	15·83	9·28	3·00	12·15	21·00	
	3·10				24·14					
4·62	5·61		14·88	6·07	20·95	14·88		7·50	29·28	
	2·00					7·00	4·00			
1·64	2·00	6·88	2·24	6·39	15·51	9·12	6·27	7·15	23·16	
7·14	8·67				13·67			9·45		
6·97	8·46	trace....	14·23	1·92	16·15	14·23	7·74	6·45	41·09	
7·21	9·43				8·61			6·90		
8·65	10·51	1·60	2·24	1·44	5·28	3·84	0·44	7·20	26·03	
						8·00				
2·09	2·53	8·15	2·57	6·07	16·79	10·72	2·18	11·25	22·15	

TABLE I.—Statement of the Results of Examining 128 Standard Samples

Number of Sample.	Designation.	Name of Manufacturer.	By whom sent.	From what Materials Produced.	——
1384	No. 1 Grade	Nichols Chemical Co. of Canada, Ltd. Capelton, P.Q.	S. L. Stafford, Manager, Capelton, Que.	Canadian Apatite dissolved in Sulphuric Acid, Muriate of Potash, and Sulphate of Ammonia.	Guaranteed contents Standard sample....
1385	Reliance	" ..	" ..	" ..	Guaranteed contents Standard sample....
1386	Royal Canadian.....	" ..	" ..	" ..	Guaranteed contents Standard sample.. .
1387	Victor.....	" ..	" ..	" ..	Guaranteed contents Standard sample....
1388	Crown	" ..	" ..	" .	Guaranteed contents Standard sample....
1389	Reid's Superphosphate.	Thos. Reid, St. John, N.B.	Manufacturer, St. John, N.B.	... .	Guaranteed contents Standard sample....
1390	Crocker's Wheat and Corn Fertilizer.	American Agricultural Chemical Co., of Buffalo, N.Y.	Geo. W. Bingham, Local Manager.	....	Guaranteed contents Standard sample ...
1391	Crocker's Cabbage and Potatoe Manure.	" ..	" ..	.....	Guaranteed contents Standard sample....
1392	Crocker's Harvest Jewel.	" ..	" ..	....	Guaranteed contents Standard sample ...
1393	Crocker's Ammoniated Bone.	" ..	" ..	....	Guaranteed contents Standard sample ..
1394	Fertilizer.....	Laing Packing and Provision Co., Ltd., Montreal.	Manufacturer, Montreal.	Offal, Blood and Bones of Hogs.	Guaranteed contents Standard sample....
1395	High Grade Potato Manure.	American Agricultural Chemical Co. of Rutland, Vt.	Great Eastern Fertilizer Branch, Rutland, Vt.	.....	Guaranteed contents Standard sample ...
1396	Thomas' Phosphate Powder.	Chemical Works of H. & E. Albert, 15 Philpot Lane, London, Eng.	. .....	Basic slag made at Middlesborough, England.	Standard sample...
1397	Williams & Clark American Potato Manure.	American Agricultural Chemical Co. of Boston, Mass.	Ross L. Coe, Local Treasurer, Boston.	.....	Guaranteed contents Standard sample...
1398	Pacific Potato Speci'l	" ..	" ..	.....	Guaranteed contents Standard sample....
1399	Pacific Nobsque Guano.	" ..	" ..	.....	Guaranteed contents Standard sample....
1400	Pacific Fine Ground Bone.	" ..	" ..	.....	Guaranteed contents Standard sample....
1401	Soluble Pacific Guano	" ..	" ..	.....	Guaranteed contents Standard sample....
1402	Tucker's Imperial Bone Superphosphate.	" ..	" ..	.....	Guaranteed contents Standard sample ..
1403	Bradley's Eclipse Phosphate.	" ..	" ..	.....	Guaranteed contents Standard sample...

SESSIONAL PAPER No. 14

of Commercial Fertilizers, registered for 1903—*Continued.*

Results of Analysis.										
Nitrogen.		Phosphoric Acid.					Potash.	Moisture.	Relative value per ton of 2,000 lbs	Name of Analyst and Remarks.
Total including that of Nitric Acid or Ammonia.	Total calculated as Ammonia.	Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.				
p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	$ cts.	
.....	.....	.....	.....	.....	.....	11·50	.....	.....	.....	
trace....	trace....	13·91	1·28	3·04	18·23	15·19	0·50	9·65	19 52	Miss S. E. Wright.
.....	2 00	.....	.....	.....	.....	6 00	2 00	.....	.....	
2 28	2·77	5·27	3 69	3·51	12·47	8·96	3·71	11·25	22 23	
.....	1 00	.....	.....	.....	.....	9 00	5·00	.....	.....	
4·21	5·11	8·95	0·14	3·83	12·92	9 09	5 99	7·05	39·75	Alphonse Lemoine.
.....	2·00	.....	.....	.....	.....	7·00	3 00	.....	.....	
2·53	3·07	10·55	0·97	4 40	15 92	11·52	2·94	9·90	24 69	
.....	2·00	.....	.....	.....	.....	11·00	2·50	.....	.....	
2 47	3·00	7·51	3 55	2·04	13·1	11·06	4·25	12 3	24 40	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
3·44	4·18	4·48	2·56	5·59	12·63	7·04	3·12	19·08	22·06	Miss E. Davidson.
2·06	2 50	6·00	.....	1·00	9·00	8 00	1 50	.....	.....	
2·75	3·34	7·51	2·09	2·71	12·31	9·60	2·37	1 20	21 74	
2·00	3·00	6 00	.....	1 00	9 00	8·00	6 00	.....	.....	
2·20	2·67	7·20	3 68	2·55	13·43	10 88	5 81	12 16	25·26	
1·65	2·00	6 00	.....	1·00	9 00	8·00	2·00	.....	.....	
1·60	2 04	7·19	1 77	2·37	11·35	8 96	2 91	10 52	18 48	"
2 40	3·00	6·00	.....	2 00	11 00	9·00	2 00	.....	.....	
2·66	3·23	7·36	1·76	3·19	12·31	9·12	3 08	10 44	21 22	
8 33	10·12	.....	.....	.....	9·40	.....	.....	.....	.....	
8 36	10·15	1 28	6·88	1·75	9·91	8·16	0·27	11 96	29·97	
.....	4·00	6 00	.....	1 00	7·00	6·00	10·00	.....	.....	
3 07	3·73	4·64	3·04	2 07	9·75	7·68	9·75	7 60	27 75	Miss E. Davidson.
.....	.....	.....	14 55	1·00	18 55	14·55	.....	0·20	18 80	
2 06	2·50	5·00	.....	2·00	10·00	8·00	3 to 4	.....	.....	
2·41	2·92	6·72	2 72	2·71	12 15	9·44	3·32	13 88	21 66	
2·06	2·50	5·00	.....	2·00	10·00	8·00	3·60	.....	.....	
2·38	2·89	7·52	2·24	2·71	12·47	9·76	3 4	13 92	22 08	
1·03	1·25	6·00	.....	2·00	10 00	8 00	2 00	.....	.....	
1·53	1·85	6·55	1·92	3·20	11 67	8 47	2·09	13·44	17 34	Miss S. E. Wright.
2 50	3·00	.....	.....	.....	21·00	.....	.....	.....	.....	
2 57	3·13	.....	17·60	6 55	24·15	17·60	.....	5 45	27 49	
2·06	2·50	5·00	.....	2·00	10·00	8·00	1 50	.....	.....	
1·85	2·24	7·68	1·75	2·88	12·31	9 34	1·85	14·00	19 74	
1 03	1·25	6 00	.....	2·00	10·00	8 00	2·00	.....	.....	
1·51	1 84	6·08	3·19	2·56	11·83	9 27	1·64	13·45	16 91	
1·03	1·25	6·00	.....	2·00	10 00	8·00	2·00	.....	.....	
1·10	1·42	6 40	3 35	3·84	13·59	9 75	2·09	11·10	17 56	

TABLE I.—Statement of the Results of Examining 128 Standard Samples

Number of Samples.	Designation.	Name of Manufacturer.	By whom sent.	From what Materials Produced.	
1404	Bradley's XL Superphosphate of Lime.	American Agricultural Chemical Co. of Boston, Mass.	Ross L. Coe, Local Treasurer, Boston.	....	Guaranteed contents Standard sample....
1405	Bradley's Potato Fertilizer.	" " .. " "			Guaranteed contents Standard sample....
1406	Bradley's Farmers' New Method Fertilizer.	" " .. " "			Guaranteed contents Standard sample....
1407	Bradley's Fine Ground Bone.	" " .. " "			Guaranteed contents Standard sample....
1408	Read's Standard Superphosphate.	" " .. " "			Guaranteed contents Standard sample ...
1409	Read's Practical Potato Special.	" " .. " "			Guaranteed contents Standard sample....
1410	Read's Sure Catch Fertilizer.	" " .. " "			Guaranteed contents Standard sample....
1411	Quinnipiac Climax Phosphate for all crops.	" " .. " "			Guaranteed contents Standard sample....
1412	Cumberland Superphosphate.	" " .. " "			Guaranteed contents Standard sample....
1413	Cumberland Potato Fertilizer.	" " .. " "			Guaranteed contents Standard sample....
1414	Cumberland Fine Ground Bone.	" " .. " "			Guaranteed contents Standard sample....
1415	Brand 'H' Fertilizer	W. Harris & Co., Toronto.	Manufacturers. ..	....	" "
1416	Bone Meal..	" " .. " "			" "
1417	Superphosphates of Lime.	Standard Fertilizer & Chemical Co., Ltd., Smith's Falls, Ont.	R. J. Brodie, President and M'n'g'r, Smith's Falls.	Mineral phosphate, nitrate of soda, sulphate of ammonia, magnesia salts, mineral superphosphates, bone char and fine bone meal.	Guaranteed contents Standard sample ...
1418	Special Fertilizer ...	" "		" " ...	Guaranteed contents Standard sample....
1419	Standard Fertilizer	" "		" " ..	Guaranteed contents Standard sample....
1420	Star Fertilizer	" "		" " ..	Guaranteed contents Standard sample....
1421	No. 1 Fertilizer....	" "		" " ..	Guaranteed contents Standard sample....
1422	Royal Fertilizer....	" "		" " ..	Guaranteed contents Standard sample....
1423	Bone Meal...	" "		....	Guaranteed contents Standard sample....
1424	Nitrate of Soda	" "		.... ..	Guaranteed contents Standard sample....
1425	Freeman's Sure Growth Manure.	W. A. Freeman Co., Ltd., Hamilton, Ont.	Wm. Freeman, Hamilton, Ont.	....	Guaranteed contents Standard sample....
1426	Freeman's Bone and Potash.	" "		... .	Guaranteed contents Standard sample....

of Commercial Fertilizers, registered for 1903—*Continued.*

Results of Analysis.										
Nitrogen.		Phosphoric Acid.					Potash.	Moisture.	Relative value per ton of 2,000 lbs	Name of Analyst and Remarks.
Total including that of Nitric Acid or Ammonia.	Total calculated as Ammonia.	Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.				
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.	
2·06	2·50	5·00	.....	2·00	10·00	8·00	1·50	.....	.....	
2·00	2·43	6·07	2·62	2·50	11·19	8·69	1·60	13·80	17 79	Alphonse Lemoine.
2·06	2·50	5·05	.....	2·00	10·00	8·00	3·00	.....	.....	
2·07	2·51	6·07	1·39	2·23	10·23	9·00	3·48	13·95	18 46	
1·03	1·25	6·00	.....	2·00	10·00	8·00	2 00	.....	.....	
1·22	1·47	6 07	1·48	2·87	10·42	7·55	2·14	13·55	15 18	Below standard required by Fertilizer's Act.
2·50	3·00	.....	.....	.....	21·00	.....	.....	.....	.....	
2 78	3·38	Trace.	14 40	9 27	23·67	14 40	.....	4·25	25 29	Alphonse Lemoine.
0·82	1 00	5·00	.....	2·00	10·00	8 00	4 00	.....	.....	
1·19	1 45	5 11	4·17	3·35	12·63	9 28	1 48	12 16	19 51	Miss E. Davidson.
0 82	1 00	2·00	.....	1·00	5·00	4 00	8·00	.....	.....	
1·06	1·29	3 99	2 41	2·07	8·47	6 40	8 69	6 04	19 95	
.....	.....	6·00	.....	1·00	11·00	10·00	2 00	.....	.....	
0·20	0·24	7 83	3 20	2·72	13·75	11·03	2 28	10 92	16 65	
1·03	1·25	6·00	.....	2·00	10·00	8 00	2·00	.....	.....	
1 08	1·31	6·23	3·05	2 72	12·00	9 28	2 41	13·44	16 98	
2 06	2·50	5·00	.....	2·00	10·00	8 00	1·50	.....	.....	
2·06	2 5	6·23	2 89	2 87	11 99	9 12	2·39	14 88	19 39	
2·06	2·50	5·00	.....	2 00	10 00	8 00	3·00	.....	.....	
2·11	2 56	4 47	3 66	2 87	11·00	8 13	3 12	13 3	19 02	Alphonse Lemoine
2·50	3 00	.....	.....	.....	21 00	.....	.....	.....	.....	
3·09	3 75	.....	12 48	9 40	21 88	12 48	.....	4 95	23 97	
8·51	10·33	.....	3·71	3·32	7·03	3 71	Trace.	14·95	27 21	
5·15	6 25	.....	9·87	8 63	18·50	9 87	.....	3·85	25 91	
.....	.....	.....	.....	.....	16·00	14·00	.....	.....	.....	
.....	.....	10·68	3·27	3·00	16 95	13 95	.....	12 40	17 32	Miss E. Davidson.
.....	3·50	.....	.....	.....	10·00	8·00	6·00	.....	.....	
3·92	4 76	7·99	2·09	1·43	11 51	10·08	7·06	15·04	29 92	
.....	2·50	.....	.....	.....	11·00	9 00	2 00	.....	.....	
2·95	3·58	8·64	1 67	2 55	12·86	10·31	2 76	12·24	23 54	
.....	2·00	.....	.....	.....	7 00	5·00	2·00	.....	.....	
1·79	2·17	6·07	0·79	1·60	8 46	6 86	2·12	5 04	15 51	
.....	2·00	.....	.....	.....	11 00	9·00	1·00	.....	.....	
1·89	2 29	7 68	2·15	2·71	12 54	9 83	1·89	16 44	19 28	
.....	2·00	.....	.....	.....	10·00	8·00	3·00	.....	.....	
2·00	2·43	5 56	2·12	2·87	10·55	7·68	3·08	10 4	18 24	Alphonse Lemoine
.....	4·00	.....	.....	.....	.....	20·00	.....	.....	.....	
3·62	4·40	Trace.	11 64	11 64	23·28	11·64	None.	5 45	24 98	
.....	18·00	.....	.....	.....	.....	.....	.....	.....	.....	
15·40	18·70	.....	.....	.....	.....	.....	.....	.....	40 04	
.....	3·50	.....	.....	.....	8·00	.....	3·00	.....	.....	
3·32	4·03	3·32	3 72	4·47	11 51	7·04	3·14	14 50	21 34	
.....	2·00	.....	.....	.....	9·00	.....	6·00	.....	.....	
2·78	3·38	3·19	3·53	4·15	10·87	6·72	6·03	13 45	22 01	

TABLE I.—Statement of the Results of Examining 128

Number of Sample.	Designation.	Name of Manufacturer.	By whom sent.	From what Materials Produced.	—
1427	Freeman's Celery and Early Vegetable Manure.	The W. A. Freeman Co., Ltd., Hamilton.	W. A. Freeman, Hamilton, Ont.		Guaranteed contents Standard sample...
1428	Freeman's Grass and Grain.	"			Guaranteed contents Standard sample...
1429	Freeman's Phosphate Powder.	"			Guaranteed contents Standard sample....
1430	Freeman's Potato Manure.	"			Guaranteed contents Standard sample ...
1431	Freeman's Tankage Manure.	"			Guaranteed contents Standard sample
1432	Freeman's Tobacco Manure.	"			Guaranteed contents Standard sample....
1433	Freeman's Pure Bone Meal.	"			Guaranteed contents Standard sample....
1434	Ingersoll Fertilizer A.	Ingersoll Packing Co., Ingersoll, Ont.	C. C. L. Wilson, manager, Ingersoll, Ont.	Blood, tankage and bone from the hog.	Guaranteed contents Standard sample.... Second sampling....
1435	Fertilizer.....	London Soap Co., London, Ont.	Manufacturer. ...	.....	Standard sample....
1436	Bradley's New Method	The American Agricultural Chemical Co., Buffalo, N.Y.	Sales Department, Buffalo, N.Y.		Guaranteed contents Standard sample....
1437	Bradley's B. D. Sea Fowl Guano.	"			Guaranteed contents Standard sample.
1438	Bradley's Complete Manure for Potatoes and Vegetables	"			Guaranteed contents Standard sample....
1439	Bowker's Vermont Phosphate.	Bowker Fertilizer Co., Boston, Mass.	F. Miller, advertising manager, Boston, U.S.	Bone, bone black, phosphoric guano, bone phosphates, dried blood meat or fish, sulphate of ammonia or nitrate of soda, sulphate of potash or muriate of potash and sulphuric acid.	Guaranteed contents Standard sample....
1440	Bowker's Sure Crop Phosphate.	"			Guaranteed contents Standard sample....
1441	Bowker's Potash Bone.	"			Guaranteed contents Standard sample ...
1442	Bowker's Farm and Garden Phosphate.	"			Guaranteed contents Standard sample ...
1443	Bowker's Corn Phosphate.	"		Bone, bone black, phosphatic guano, bone phosphates, dried blood, meat or fish, sulphate of ammonia or muriate of potash and sulphuric acid.	Guaranteed contents Standard sample....
1444	Bowker's Bone and Potash Square Brand.	"			Guaranteed contents Standard sample....
1445	Bowker's Potato and Vegetable Phosphate.	"			Guaranteed contents Standard sample....
1446	Stockbridge Potato and Vegetable Manure.	"			Guaranteed contents Standard sample ...

Standard Samples of Commercial Fertilizers, &c.—*Continued.*

Results of Analysis.										
Nitrogen.	Phosphoric Acid.								Relative Value per Ton of 2,000 lbs.	Name of Analyst and Remarks.
Total including that of Nitric Acid and Ammonia.	Total Calculated as Ammonia.	Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.	Potash.	Moisture.		
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	
	6·00				9·00		6 00			
4 48	5·44	3·83	2 89	3·83	10·55	6 72	6 83	11·72	27·75	Miss E. Davidson.
	2·00				9·00		1 00			
2·59	3·14	2·87	3·37	3·83	10·07	6 24	3 47	10 16	18 67	"
					15·00					
0·36	0·44	9·91	4·17	3·99	18·07	14 08		11·96	18·62	"
	3·00				9·00		5 00			
2·95	3 58	4·31	3·53	4·79	12·63	7·84	7·54	13·16	26 08	"
	5 00				12·00					
6·16	7·48	0·63	11·68	3·99	16·30	12·31		4·68	29 59	"
	6·00				7·00		7 00			
5·64	6 85	3 6	3·44	3·32	10·36	7·04	6·30	11·60	26·48	Alphonse Lemoine.
	3·00				23·00					
3·5	4·25	None...	13·24	13·56	26·8	13.24	None.	6·90	27·13	"
	9·00				6·80			8·00		
7·92	8·40	Trace...	11·84	2·36	14·20	11 84	0·20	15·12	32·94	"
7 67	9·32		11 99	2·72	14·71	11·99	Trace.	14·05	32 41	"
9 21	11·18	Trace...	1·27	2·23	3·6	1·27	0·30	11·75	26·33	
0·82	1·00			1·00	9·00	8 00	2·00			
1 21	1 47	5 56	4·04	Trace.	9·6	9·60	2·25	10·3	16·62	"
2·06	2·50	6·00		1·00	9·00	8·00	1·50			
2 78	3·38	6·07	2·76	2·11	10·94	8·83	1·62	14·65	19·88	"
3·29	4 00	6·00		1·00	9·00	8·00	7·00			
4 14	5 03	5·75	2·89	2·55	11·19	8·64	7·10	9 35	29 30	"
	3·00				10·00	8 00	4·00			
2·45	2·98	5 24	3·72	1.92	10·87	8 96	4 50	13·00	21·99	"
	1·00				11·00	9·00	2·00			
1·48	1 8	5·75	3·72	1 72	11·19	9·47	4·09	9 36	19·66	"
	1·00				8·00	6·00	2·00			
1·23	1·49	2·11	4·61	1·72	8·44	6·72	2·35	7·85	13·53	"
	2·00				10·00	8 00	2·00			
1·90	2·31	5 76	3 68	1 59	11 03	9·44	2·10	10 48	18·58	Miss E. Davidson.
	2·00				10·00	8·00	2·00			
1 60	1·94	5·76	3 35	1 44	10 55	9 11	2 00	11 64	17 28	"
	2·00				10 00	6 00	2·00			
1 62	1 97	3·00	5·13	4 79	12·92	8·13	2·37	6·72	17 06	"
	2·00				11·00	9 00	2·00			
1·95	2·36	7·56	2·67	1 28	11·51	10·23	2·88	3·52	20·48	"
	4·00				7·00	6·00	10·00			
3·32	4·03	5 12	2 40	1 59	9·11	7·52	11·43	9 16	29·89	"

TABLE I.—Statement of the Results of Examining 128 Standard Samples

Number of Samples.	Designation.	Name of Manufactuer.	By whom sent.	From what Materials Produced.	
1447	New England Corn Phosphate.	The New England Fertilizer Co., Boston, Mass.	A. P. Clarke, agent, Boston, Mass.	Blood, meat, bone, bone black, bone phosphates, nitrates of soda or sulphates of ammonia and sulphate or nitrate of potash.	Guaranteed contents Standard sample....
1448	New England Potato Fertilizer.	" ..	" ..		Guaranteed contents Standard sample....
1449	New England Seeding down Fertilizer	" ..	"		Guaranteed contents Standard sample....
1450	Swift's Lowell Bone Fertilizer.	Lowell Fertilizer Co., Boston, Mass.	Benjamin Moody, agent.	Blood, meat, bone, bone black, bone phosphates, nitrate of soda, or sulphate of ammonia and sulphate or nitrate of potash.	Guaranteed contents Standard sample....
1451	Swift's Lowell Potato Manure.	"			Guaranteed contents Standard sample....
1452	Swift's Lowell Potato Phosphate.	"			Guaranteed contents Standard sample....
1453	Swift's Lowell Animal Brand.	"			Guaranteed contents Standard sample....
1454	Swift's Lowell Ground Bone.	" ..	..		Guaranteed contents Standard sample....
1455	Packer's Union Potato Manure.	The American Agricultural Chemical Co., Rutland, Vt.	Packers Union Fertilizer Branch, Rutland, Vt.		Guaranteed contents Standard sample....
1456	Packer's Union Wheat, Oats and Clover Fertilizer.	" ..	" ..		Guaranteed contents Standard sample....
1457	Packer's Union Economical Vegetable Guano.	" ..	"		Guaranteed contents Standard sample. ..
1458	Palmerston Tankage	Palmerston Pork Packing Co.		Bone, blood and general packing house refuse.	Standard sample....
1459	Bone Meal..... ...	Darch & Hunter, London, Ont.			Standard sample....
1460	Alberts' Concentrated Soluble Horticultural Manure Brand A.G.	Chemical Works, late H. & E. Albert, Biebrich on Rhine.	F. W. Wedderburn, St. John, N.B.		Guaranteed contents Standard sample....
1461	Potato Phosphate...	Nova Scotia Fertilizer Co., Halifax, N.S.	C. M. Jack, Halifax, N.S.	Bonechar, bone, dried blood, tankage, bone phosphates, sulphate of ammonia, nitrate of soda, high grade muriate of potash or sulphate of potash, and sulphuric acid.,	Guaranteed contents Standard sample....
1462	Ceres Superphosphate.	"	" ..	"	Guaranteed contents Standard sample....
1463	Bone Meal	"	" ..	"	Guaranteed contents Standard sample....
1464	Strawberry Phosphate.	"	" .	"	Guaranteed contents Standard sample ...
1465	Apple Tree Phosphate.	..	"	" ..	Guaranteed contents Standard sample....

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of Commercial Fertilizers, registered for 1903—*Continued.*

RESULTS OF ANALYSIS.

Nitrogen.		Phosphoric Acid.					Potash.	Moisture.	Relative value per ton of 2,000 lbs	Name of Analyst and Remarks.
Total including that of Nitric Acid or Ammonia.	Total calculated as Ammonia.	Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.				
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts,	
	2·00				9·00	8·00	3·00			
1·98	2·40	5·11	3·65	1·28	10·04	8·76	3·48	9·7	19·32	Alphonse Lepine.
	2·00				8·00	7·00	4·00			
1·94	2·38	5·11	3·08	1·08	9·27	8·19	4·51	7·6	19·62	
	1·50				8·00	7·00	2·06			
1·73	2·09	4·60	3·97	0·70	9·27	8·57	2·27	9·15	16·98	
	2·00				9·00	8·00	3·00			
1·84	2·23	5·43	3·85	1·08	10·36	9·28	3·55	10·15	19·60	
	2·00				8·00	7·00	4·00			
1·87	2·26	5·43	2·43	0·9	8·76	7·86	4·65	7·1	19·20	
	3·00				9·00	8·00	6·00			
2·88	3·50	7·83	2·41	1·59	11·83	10·24	5·85	7·84	26·16	Miss E. Davidson.
	3·00				10·00	9·00	4·00			
2·78	3·38	7·99	2·88	0·80	11·67	10·87	3·99	9·72	24·42	
	3				23·00					
2·99	3·63		14·23	12·95	27·18	14·23		6·28	26·71	
2·06	2·50	5·00		1·00	10·00	8·00	6·00			
2·23	2·70	5·43	5·29	1·91	12·63	10·72	6·47	10·68	25·50	
		6·00		1·00	12·00	11·00	2·00			
Trace...	Trace...	7·99	3·37	2·39	13·75	11·36	2·24	11·00	16·37	
1·25	1·50	4·50		1·00	7·00	6·00	3·00			
2·25	2·73	4·60	4·23	5·88	14·71	8·83	3·25	13·2	21·19	Alphonse Lepine.
6·37	7·73	Trace.	9·15	2·36	11·51	9·15	1·81	13·40	27·96	Alphonse Lepine.
2·28	2·77	Trace.	12·85	15·35	28·2	12·85		3·50	24·20	
12·62		11·01					19·10			
12·82	15·56	9·91	2·05		11·96	11·96	18·90	1·85	67·31	
	3·71				7·82		4·79			
3·30	4·01	4·92	0·84	1·91	7·67	5·76	3·71	5·50	19·21	
	2·00				9·16			2·14		
2·63	3·19	6·07	1·77	1·91	9·75	7·84	5·12	7·37	22·02	Miss S. E. Wright.
	3·00				22·90					
2·98	3·62	Trace.	15·66	10·39	26·05	15·66		8·75	27·50	
	2·02				8·25		6·50			
2·23	2·70	3·83	3·84	2·72	10·39	7·67	6·45	6·15	22·21	
	3·25				7·82		6·52			
2·65	3·11	4·15	1·92	3·04	9·11	6·07	7·13	6·85	22·38	

TABLE I.—Statement of the Results of Examining 128 Standard Samples

Number of Sample.	Designation.	Name of Manufacturer	By whom sent.	From what Materials Produced.	
1466	Ground Bone	The Dominion Packing Co.	W. D. Haddlesey, Charlottetown, P.E.I.		Standard sample
1467	Dried Blood	" "	" "		Standard sample
1468	Tankage	" "	" "	Blood, bone, and tankage or the offal from animals.	"
1469	Mixed Fertilizer	" "	" "	Blood, bone tankage, muriate of potash and nitrate of soda.	"
470	Fertilizer, Bone Meal		Illsley & Harvey, Port William, N. S.		"
1471	Homestead, a Bone Black Fertilizer.	Michigan Carbon, Co. Detroit, Mich.	Wm. H. Burtenshaw, Sec. Tres'r, Detroit.		Guaranteed contents Standard sample
1472	Homestead Potato and Tobacco Fertilizer.	" "	" "		Guaranteed contents Standard sample
1473	Pure Animal Bone and Potash.	" "	" "		Guaranteed contents Standard sample
1474	Dessicated Bone	" "	" "		Guaranteed contents Standard sample
1475	Market Garden and Potato Fertilizer.	Russia Cement Co., Gloucester, Mass.	S. C. Shaffner, Granville Ferry, N.S.		Guaranteed contents Standard sample
1476	Muriate of Potash	Victoria Chemical Co., Ltd., Victoria, B.C	John A. Hall, Treasurer, Victoria, B.C.		Guaranteed contents Standard sample
1477	Kainite	" "	" "		Guaranteed contents Standard sample
1478	Sulphate of Potash	" "	" "		Guaranteed contents Standard sample
1479	Thomas' Phosphate Powder.	" "	" "		Guaranteed contents Standard sample
1480	Nitrate of Soda	" "	" "		Guaranteed contents Standard sample
1481	Superphosphate of Lime.	" "	" "	Spent bone char and sulphuric acid.	Guaranteed contents Standard sample
1482	Fertilizer A	" "	" "	Nitrate of soda. muriate of potash and superphosphate of lime.	Guaranteed contents Standard sample
1483	" B	" "	" "	" "	Guaranteed contents Standard sample
1484	" C	" "	" "	Muriate of potash and superphosphate of lime.	Guaranteed contents Standard sample
1485	Offal	Black & Shortreed, Fergus, Ont.	Manufacturers	Bone, sinew and offal of beef animals only.	Standard sample
1486	Dried Blood	" "	"		Standard sample

Samples of Commercial Fertilizers, &c.—*Continued.*

Results of Analysis.											
Nitrogen.		Phosphoric Acid.								Relative value per ton of 2,000 lbs	Name of Analyst and Remarks.
Total including that of Nitric Acid or Ammonia.	Total calculated as Ammonia.	Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.	Potash.	Moisture.			
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.		$ cts.	
4·17	5·07	.. ..	13·43	7·35	20·78	13·43	.....	8·00		26 98	Miss E. Davidson
9·66	11 73	0·64	1·61	0 31	2·56	2·25	2·23	29·96		28 52	..
5 32	6 46	0·63	12 16	6 71	19 50	12 79	2·33	7·20		31 37	..
4 98	6·05	0·95	9 77	4 15	14·87	10·72	7·78	6 48		33 25	..
4 15	5·05	Trace.	6 07	20·31	26 38	6·07	1 98	7·52		24 78	..
2·06	2 50	.....	.....	.....	9·00	8·00	1·50	.....		.....	
1 98	2·41	7 35	0 65	1 91	9 91	8 00	1·97	12·05		16 93	Alphonse Lemoine.
2·66	2·50	.....	.....	.....	9 00	8 00	3·00	.....		.....	
2 03	2·46	7 35	0·51	1·28	9 14	7 86	3·31	11 90		18 49	..
0·82	1·00	.....	.....	.....	22 00	.....	6 00	.....		.....	..
0·88	1·07	None.	16 63	14 52	31·15	16·63	5·95	1 80		31 00	
.....	1·50	.....	.....	.....	25·00	.....	.....	.....		.....	..
1·27	1·54	None.	17·01	15·99	33·00	17·01	Trace.	2·75		26 56	
2·00	2 40	4·00	...	2 00	10·00	8·00	5 00				
2·09	2·53	3 83	7·69	3·51	15·03	11·52	6 37	10·5		26 23	..
.....	.....	.....	.....	.....	.....	.....	53 00	.....		.....	
.....	.....	.....	.....	.....	.....	.....	55·58	0 12		58 36	Miss E. Davidson.
.....	.....	.....	.....	.....	.....	.....	12·00	.....		.....	
.....	.....	.....	.....	.....	.....	.....	13·93	10·08		14 63	..
.....	.....	.....	.....	.....	.....	.....	53 00	.....		.....	
.....	.....	.....	.....	.....	.....	.....	53 46	6·00		56 13	..
.....	.....	.....	.....	.....	15·00	.....	.....	.....		.....	
.....	.....	.....	12·47	4·31	16·78	12·47	.....	0·04		16 74	..
16·00	.....	.....	.....	.....	.....	.....	.....	.....		.....	
15·93	19 35	.....	.....	.....	.....	.....	.....	0·65		41 42	Alphonse Lemoine
.....	.....	.....	.....	.....	16·00	.....	.....	.....		.....	
Trace.	Trace.	16·12	2·56	0·64	19·32	18 68	.....	12·70		22 35	..
4·00	.....	.....	.....	.....	10 00	.....	7 00	.....		.....	
3 46	4·20	10·55	0·96	0·64	12·15	11·51	7·51	10·07		30 79	..
3·50	.....	.....	.....	.....	9 00	.....	11·00	.....		.....	
2·79	3·38	10·23	1·60	.. .	11·83	11·83	12·03	9·40		33 92	..
.....	.....	.....	.....	.....	12·50	.....	11 00	.....		.....	
.....	.....	14·52	1·47	....	15·99	15·99	11 56	9·10		31 16	
6·56	7 98	1·28	6 94	5·08	13·30	8 22	0·75	6·40		27 23	..
10·10	12·27	1·28	0·38	0·70	2·36	1·66	0·61	20·35		27 54	..

TABLE I.—Statement of the Results of examining 128 Standard

Number of Sample.	Designation.	Name of Manufacturer.	By whom sent.	From what Materials Produced.	——
1487	Eureka Potato Manure.	Pidgeon Fertilizer Co., Ltd., Windsor, N.S.	Robert Pidgeon, Manager.	.....	Standard sample ...
1488	Eureka Phosphate ..	" " ..	" " ..	.....	Standard sample....
1489	Intense Brand.....	" " ..	" " ..	.....	Standard sample....
1490	Ground Bone.....	" " ..	" " ..	.....	Standard sample....

Samples of Commercial Fertilizers, registered for 1903—*Concluded.*

Results of Analysis.											
Nitrogen.		Phosphoric Acid.					Pot-ash.	Moist-ure.	Relative value per ton of 2,000 lbs	Name of Analyst and Remarks.
Total including that of Nitric Acid and Ammonia.	Total calculated as Ammonia.	Soluble in Water.	Citric Soluble.	In soluble.	Total.	Total available.				
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.	
3·07	3·73	1·91	0·97	8·12	11·00	2·88	5·05	9·10	19 08	Alphonse Lemoine; under standard required by the Act and therefore not legally saleable.
2·87	3·48	0·48	2·40	9·27	12·15	2·88	2·35	11·60	15 93	Miss E. Davidson; under standard required by the Act and therefore not legally saleable.
2·27	2·75	0·64	0·96	8·31	9·91	1·60	5·31	12·28	15 79	" "
2·37	2·87	.....	16·31	7·03	23·34	16·31	..	6·88	25·74	Miss E. Davidson.

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name or Brand of Fertilizer.	Nitrogen. Total including that of Nitric Acid or Ammonia if present.	Nitrogen. Total, calculated as Ammonia.
1903.					p. c.	p. c.
April 16	20235	L. B. Wyman, Yarmouth, N.S.	Swift Fertilizer Co., Lowell, Mass.	Potato Phosphate—		
				As guaranteed		3·06
				Standard sample (1452)	2·88	3·50
				Sample as sold	2·75	3·34
" 18	20242	W. M. Carruthers, Kentville, N.S.	Russia Cement Co., Gloucester, U.S.	Corn, Grain and Grass Brand—		
				As guaranteed		4·00
				Standard sample (1368)	2·58	3·13
				Sample as sold	3·71	4·50
" 18	20243	"	"	Potatoes, Roots and Vegetable Fertilizer—		
				As guaranteed		4·50
				Standard sample (1369)	3·29	4·00
				Sample as sold	4·09	4·96
" 18	20244	Wolfville Coal Co., Wolfville, N.S.	Bowker&Co., Boston, Mass.	Stockbridge Brand—		
				As guaranteed		4·00
				Standard sample (1446)	3·32	4·03
				Sample as sold	3·51	4·27
" 18	20245	"	"	Potato Phosphate—		
				As guaranteed		2·00
				Standard sample (1445)	1·95	2·36
				Sample as sold	2·00	2·43
" 18	20247	Illsley and Harvey, Wolfville, N.S.	Vendors	Calcutta Bone—		
				As guaranteed		
				Standard sample (1470)	4·15	5·05
				Sample as sold	3·89	4·73
" 18	20261	F. W. Dimock, Windsor, N.S.	Nova Scotia Fert. Co., Halifax.	Ground Bone—		
				As guaranteed		3·00
				Standard sample (1463)	2·98	3 62
				Sample as sold	2·98	3·62
" 22	20303	J. H. Kent, Truro, N.S.	Bowker & Co., Boston, Mass.	Fresh Ground Bone—		
				As guarantred		
				Standard sample		
				Sample as sold	3·15	3·82
" 30	20324	Wm. McV. Smith, Dartmouth, N.S.	Hattie & Mylins, Halifax (Provincial Chemical Fertilizer Co., St. John, N.B.)	Imperial Superphosphate—		
				As guaranteed		3·00
				Standard sample (1376)	3·03	3·68
				Sample as sold	1·66	2·02
" 30	20327	E. M. Walker, Dartmouth, N.S.	American Agricultural Chemical Co., Boston.	Potato Special Fertilizer—		
				As guaranteed	2·06	2·50
				Standard sample (1398)	2·38	2·89
				Sample as sold	1·79	2·17
" 20	4325	R. I. Holman, Summerside, P.E.I.	Wallace & Frazer, St. John, N.B.	Alberts Thomas Phosphate Powder—		
				As guaranteed		
				Standard sample (1396)		
				Sample as sold		
" 23	4343	R. E. Mutch, Charlottetown.	NovaScotiaFertilizer Co., Halifax, N.S.	Potato Phosphate—		
				As guaranteed on label		3·71
				Standard sample (1461)	3·30	4·01
				Sample as sold	0·98	1·19
" 23	4344	A. Gill, Charlottetown, P.E.I.	Bowker Fertilizer Co., Boston, Mass.	Potato and Vegetable Phosphate—		
				As guaranteed on label		2·06
				Standard sample (1445)	1·95	2·36
				Sample as sold	1·87	2·27

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Samples of Fertilizers as sold in 1903.

Results of Analysis.									
Phosphoric Acid.									
Soluble in Water.	Citric soluble.	Insoluble.	Total.	Total Available.	Potash	Moisture.	Relative value per ton of 2,000 lbs	No. of Sample.	Name of Analyst and Remarks.
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
.....	.....	.....	9·00	8·00	6·00	.....	.....	20235	
7·83	2·41	1·59	11·83	10·24	5·85	7·84	26 16		
6·84	2·26	1·40	10·50	9·10	8·18	7·15	26 86		Mr. A. Lemoine; genuine
3·00	.....	2·50	9·50	7·00	9 50	.....	.....	20242	
6·72	2·40	2·23	11·35	9·12	10·50	3·60	35 17		
3·50	5·70	1·40	10·60	9·20	11·12	9·55	32 22		" "
3·00	.....	2·00	9·00	7 00	9·00	.....	.....	20243	
7·03	3·05	3 99	14·07	10·05	8·82	6·84	30 78		
5·60	3·84	3·19	12·63	9·44	8·54	5·88	31 50		Miss E. Davidson "
.....	.....	.....	7·00	6·00	10·00	.....	.....	20244	
5·12	2·40	1 59	9·11	7·52	11·43	9·16	29 89		
3·36	3·52	1·92	8·80	6·88	10·47	11·76	28 60		" "
.....	.....	.....	11·00	9·00	2·00	.....	.....	20245	
7 56	2·67	1·28	11·51	10·23	2·88	3·52	20 48		
5·12	4·00	2·87	11 99	9·12	2 62	11·36	19 35		" "
.....	.....	.....	.....	.....	.....	.....	.....	20247	
Trace.	6·07	20·31	26·38	6·07	1·98	7·52	24 78		
.....	14·39	11·19	25·58	14·39	.....	10·84	28 53		" "
.....	.....	.....	22·90	.....	.....	.....	.....	20261	
Trace.	15·66	10·39	26·05	15·66	.....	8·75	27 50		
.....	16·45	9·91	26·36	16·45	.....	6·60	28 21		Miss S. E. Wright; genuine
Not registered.									
.....	.....	.....	.....	.....	.....	.....	.....	20303	
.....	.....	.....	.....	.....	.....	.....	.....		
.....	13·76	6·23	19·99	13·76	.....	2·20	24 57		"
.....	.....	.....	.....	.....	.....	.....	.....	20324	
7·35	2·73	7·67	17·75	10·08	1·35	11·65	23 41		
4·63	4·16	7·68	16·47	8·79	3·67	12·05	20 61		" deficient in ammonia.
5·00	.....	2 00	10·00	8·00	3 00	.....	.....	20327	
7·52	2·24	2·71	12·47	9·76	3·44	13·92	22 08		
7·83	2·40	3·20	13·43	10·23	6·97	10·85	24 97		Miss S. E. Wright; genuine.
.....	.....	.....	.....	.....	.....	.....	.....	4325	
.....	14·55	4 00	18·55	14·55	.....	.....	18 89		
.....	13·60	6·23	19·83	13·60	.....	Trace.	19 32		" "
.....	.....	.....	7·82	.....	4.70	.....	.....	4343	
4·92	0·84	1·91	7·67	5·76	3·71	9·30	19 21		
1 59	4·17	1·72	7 48	5·76	2·51	15·35	12 21		Alph. Lemoine; deficient in ammonia.
.....	.....	.....	11·00	9·00	2·00	.....	.....	4344	
7·56	2·67	1·28	11·51	10·23	2·88	3·52	20 48		
3·64	5·42	2·04	11·00	8·96	2·45	16·75	18 26		Alph. Lemoine; genuine.

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name or Brand of Fertilizer.	Nitrogen. Total including that of Nitric Acid or Ammonia if present.	Nitrogen. Total calculated as Ammonia.
1903.					p. c.	p. c.
April 23	4345	A. Horne, Charlottetown, P.E.I.	Lowell Fertilizer Co., Boston, Mass.	Swift's Lowell Animal Fertilizer—		
				As guaranteed on label ...	.....	3·00
				Standard sample (1453) ...	2·78	3·38
				Sample as sold	2·35	2·85
" 23	4346	Dominion Packing Co., Charlottetown, P.E.I.	Dominion Packing Co., Charlottetown, P.E.I.	Blood Fertilizer—		
				As guaranteed	.....	.....
				Standard sample (1467) ...	9·66	11·73
				Sample as sold	8·90	10·81
" 11	17855	Thomas Reid, Parish of Simonds, St. John Co., N.B.	Vendor	Superphosphate—		
				As guaranteed	.....	.....
				Standard sample (1389) ...	3·44	4·18
				Sample as sold	4·11	4·99
" 13	17863	P. Nase & Son, Main St., St. John, N.B.	Swift, Lowell Fert. Co., Lowell, Mass.	Swift's Lowell Bone Fertilizer for Corn and Grain—		
				As guaranteed	.....	2·00
				Standard sample (1450) ...	1·84	2·23
				Sample as sold	3·09	3·75
" 14	17868	Provincial Chem. Fert. Co., Ltd, 89 Water St., St. John, N.B.	Vendors	Potato Phosphate—		
				As guaranteed	.....	3·75
				Standard sample (1375) ...	3·19	3·87
				Sample as sold	3·93	4·77
" 14	17869	James Collins, 210 Union St., St. John.	E. Frank Coe, New York.	"Prize Brand"—		
				As guaranteed	.....	.....
				Standard sample	.....	.....
				Sample as sold	0·84	1·02
" 16	17876	W. B. McKay & Co., Main St., Sussex, N.B.	Bowker Fert. Co., Boston.	"Farm and Garden"—		
				As guaranteed	.....	2·00
				Standard sample (1442) ...	1·90	2·31
				Sample as sold	1·68	2·04
" 17	17891	Toombs & Son, Main St., Moncton, N.B.	American Agricultural Chemical Co., Boston, Mass.	Soluble Pacific Guano—		
				As guaranteed	2·06	2·50
				Standard sample (1401)....	1·85	2·24
				Sample as sold.....	2·39	2·91
" 22	17901	Hugh McKenna, King St., St. Stephen, N.B.	Parmenter & Polsey Fertilizer Co., Peabody, Mass.	Star Brand Superphosphate—		
				As guaranteed	.....	.....
				Standard sample	.....	.....
				Sample as sold	1·39	1·68
" 22	17903	Henry E. Hill, King St., St. Stephen.	American Agricultural Chemical Co., New York.	Bradley's XL—		
				As guaranteed	2·06	2·50
				Standard sample (1404)...	2·00	2·43
				Sample as sold	1·58	1·92
" 23	17909	Small & Fisher Co., 131 Main St., Woodstock, N.B.	Provincial Chemical Fertilizer Co., St. John, N.B.	Imperial—		
				As guaranteed	.....	3·00
				Standard sample (1376) ...	3·03	3·68
				Sample as sold..	1·69	2·06
" 25	17918	L. E. Cooper, Fredericton, N.B.	American Agricultural Chemical Co., New York.	Great Eastern, Hay and Oats—		
				As guaranteed	.....	.....
				Standard sample (1363) ...	0·77	0·93
				Sample as sold.....	0·46	0·56
" 20	23349	O. Fournier, St. Alexandre, Iberville.	Bowker Fert. Co., Boston.	Corn Phosphate—		
				As guaranteed	.....	2·00
				Standard sample (1443) ...	1·60	1·94
				Sample as sold.....	1·75	2·12

SESSIONAL PAPER No. 14

Samples of Fertilizers as sold in 1903—*Continued.*

Results of Analysis.									
Phosphoric Acid.									
Soluble in Water.	Citric Soluble.	In-soluble.	Total.	Total Avail-able.	Potash.	Moist-ure.	Relative value per ton of 2,000 lbs.	No. of Sample.	Name of Analyst and Remarks.
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
.....	.....	1·00	10·00	9·00	4 00	.....	.....	4345	
7·99	2 88	0·80	11·67	10·87	3 99	9·72	24 42		
6·52	4 81	1·91	13·24	11·33	3·84	10 20	23 82		Alph. Lemoine ; genuine.
.....	.....	.....	.....	.....	.....	.....	.....	4346	
0·64	1·61	0·31	2 56	2·25	2·23	29 96	28 52		
Trace.	1·59	.....	1·59	1 59	0·77	37 35	23 92		" "
.....	.....	.....	.....	.....	.....	.....	.....	17855	
4 48	2·56	5·59	12·63	7·04	3·12	19·08	22 06		
2 39	4·33	4·79	11·51	6·72	3 04	21·60	22 92		Miss E. Davidson ; genuine
.....	.....	.....	9·00	8·00	3·00	.....	.....	17863	
5·43	3·85	1·08	10·36	9·28	3·35	10·15	19 00		
7·19	2·24	1·28	10·71	9·43	2·47	12 80	21 48		
.....	.....	.....	8 00	6·50	...	..	.. .	17868	
6 71	1·63	4·77	13·11	8·34	5·23	10 00	25 05		
7·83	1·77	3 83	13·43	9 60	5·07	7 76	28 04		
Not registered under this name.									
.....	.....	.....	.....	.....	.....	.....	.....	17869	
.....	.....	.....	.....	.....	.....	.....	.....		
8·15	2·09	4·15	14·39	10·24	2·64	12 80	18 26		"
.....	.....	.....	10·00	8·00	2·00	.....	.....	17876	
5 76	3·68	1·59	11·03	9·44	2 10	10·48	18 58		
6·88	2·39	3·04	12·31	9·27	4 44	17 75	20 83		Miss S. E. Wright ; unadulterated.
5·00	.....	2·00	10·00	8·00	1·50	..	.....	17891	
7·68	1·75	2 88	12·31	9·43	1·85	14 09	19 74		
5·43	4·17	3·51	13·11	9·60	5 46	17·10	24 08	..	" "
Not registered.									
.....	.....	.....	.....	.....	.....	.....	.....	17901	
.....	.....	.....	.....	.....	.....	.....	.....		
3 83	3·37	2 88	10·08	7·20	4·44	8·50	17 90	.	
5·00	.....	2·00	10·00	8 00	1 50	.....	.....	17903	
6·07	2 62	2·50	11·19	8·69	1·60	13·80	17 79		
6·08	3·84	3·67	13·59	9·92	6 31	11·55	23 35	.....	" "
.....	.....	.....	.....	10·50	1·50	.....	.....	17909	
7·35	2·73	7·67	17·75	10·08	1 35	11·65	23 41		
6·23	1·93	7 99	16·15	8·16	2 22	14·10	18 83	....	Miss S. E. Wright ; below guaranteed and standard.
6·00	.....	1 00	12 00	11·00	2 00	.....	.....	17918	
11·19	.....	2·88	14·07	11·19	6·24	10·90	21 04		
6·84	4·17	2 55	13·56	11·01	2·04	11·10	16 90	....	Alphonse Lemoine ; unadulterated.
.....	.....	.....	10·00	8·00	2·00	.....	.....	23349	
5·76	3·35	1·44	10·55	9·11	2 00	11·64	17 28		
5 56	2 95	1·40	9·91	8·51	2·24	12·40	17 23	....	" "

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name or Brand of Fertilizer.	Nitrogen.	
					Total including that of Nitric Acid or Ammonia if present.	Total calculated as Ammonia.
1903.					p. c.	p. c.
April 20	23350	O. Fournier, St. Alexandre, Iberville.	Bowker Fert. Co., Boston.	Potato and Vegetable Phosphate—		
				As guaranteed	.....	2·00
				Standard sample (1445)....	1·95	2·36
				Sample as sold.....	1·69	2·05
" 21	23352	A. Bergeron, Iberville.	" ..	Corn Phosphate—		
				As guaranteed	.....	2·00
				Standard sample (1443) ...	1·60	1·94
				Sample as sold.....	1·54	2·65
" 21	23353	" ..	" ..	Potato and Vegetable Phosphate--		
				As guaranteed	.....	2·00
				Standard sample (1445) ...	1·95	2·36
				Sample as sold.....	1·95	2·36
" 28	23370	H. R. Thompson, Ulverton.	American Agricultural Chemical Co., Boston.	Bradley's Eclipse Phosphate—		
				As guaranteed	1·03	1·25
				Standard sample (1403) ...	1·10	1·42
				Sample as sold.....	1·46	1·77
" 28	23371	L. S. Plamondon, South Durham.	" ..	Bradley's Eclipse Phosphate—		
				As guaranteed	1·03	1·25
				Standard sample (1403) ...	1·10	1·42
				Sample as sold.....	1·46	1·77
" 28	23375	Richard Dunn, South Durham.	Bowker Fert. Co., Boston.	Bowker's Vermont Fertilizer—		
				As guaranteed	.....	3·00
				Standard sample (1439) ...	2·45	2·98
				Sample as sold.....	2·65	3·21
" 30	23383	M. Ferland, Berthierville.	Nichol's Chemical Co., Capelton.	Victor Complete Fertilizer—		
				As guaranteed	.....	2·00
				Standard sample (1387) ...	2·53	3·07
				Sample as sold.....	2·90	3·52
May 1	23384	S. Vessat & Co., Joliette.	" ..	Victor Fertilizer—		
				As guaranteed	.....	2·00
				Standard sample (1387) ...	2·53	3·07
				Sample as sold.....	0·97	1·17
" 1	23385	" ..	" ..	Superphosphate -		
				As guaranteed	.....	.....
				Standard sample (1383) ...	2·09	2·53
				Sample as sold.....	0·57	0·69
April 7	21243	R. J. Latimer&Co., St. Maurice St., Montreal.	" ..	Victor Fertilizer—		
				As guaranteed	.....	2·00
				Standard sample (1387) ...	2·53	3·07
				Sample as sold.....	1·82	2·21
" 7	21244	" ..	" ..	Royal Canadian Fertilizer—		
				As guaranteed	.....	4·00
				Standard sample (1386) ...	4·21	5·11
				Sample as sold.....	4·06	4·93
" 7	21245	Brodie & Harvie, Bleury St., Montreal.	Standard Chemical and Fertilizer Co., Smith's Falls, Ont.	Standard Fertilizer—		
				As guaranteed	.....	2·50
				Standard sample (1419) ...	2·95	3·58
				Sample as sold.....	2·03	2·47
" 7	21246	" ..	" ..	Special Fertilizer—		
				As guaranteed	.....	3·50
				Standard sample (1418) ...	3·92	4·76
				Sample as sold.....	2·94	3·57

SESSIONAL PAPER No. 14

Samples of Fertilizers as sold in 1903—*Continued.*

Results of Analysis.									
Phosphoric Acid.					Potash.	Moisture.	Relative value per ton of 2,000 lbs.	No. of Samples.	Name of Analyst and Remarks.
Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.					
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
.....	.....	.....	11·00	9·00	2·00	.....	..	23350	
7·56	2·67	1·28	11·51	10·23	2·88	3·52	20 48		
4·28	5·70	1·40	11·38	9·98	2·37	13·65	18 69	....	Miss S. E. Wright; unadulterated.
.....	.....	.....	10·00	8·00	2·00	.....	.....	23352	
5·76	3·35	1 44	10·55	9·11	2 00	11·64	17 28		
4·92	3·40	1·72	10·04	8·32	2 37	11·00	16 55	.....	" "
.....	.....	.....	11·00	9·00	2·00	.....	.....	23353	
7·56	2·67	1 28	11·51	10·23	2·88	3·52	20 48		
3·96	5·76	1·28	11·00	9·72	2·62	10·45	19 29	....	" "
6 00	.....	2·00	10·00	8·00	2·00	.....	.....	23370	
6·40	3·35	3·84	13·59	9·75	2·09	11·10	17 56		
5·75	3·08	3·32	12·15	8·83	2·33	13·15	17 54	....	" "
6·00	.....	2·00	10·00	8·00	2·00	.....	.....	23371	
6·40	3·35	3·84	13·59	9·75	2·09	11·10	17 56		
7·67	2·25	2·87	12·79	9·92	2·29	14·60	18 73	....	" "
.....	.....	.....	10·00	8·00	4·00	.....	.....	23375	
5·24	3·72	1·92	10·87	8·96	4 50	13·00	21 99		
6·71	2·70	2 23	11·64	9·41	3·92	16·35	22 70	....	" "
.....	.....	.....	.....	7·00	3 00	.....	.....	23383	
10 55	0·97	4·40	15·92	11·52	2·94	9·90	24 69		
5·24	2·95	3·96	12·15	8·19	3·10	11·30	21 51	....	" "
.....	.....	.....	.....	7·00	3·00	.....	.....	23384	
10·55	0·97	4·40	15 92	11 52	2·94	9·90	24 69		
6·07	2·12	4·60	12·79	8·19	3·05	13·75	16 71	....	" "
.....	.....	.....	.....	8·00	.....	.....	.....	23385	
8 15	2·57	6·07	16·79	10·72	2·18	11 25	22 15		
6·72	1·60	4·80	13·12	8·32	0 27	11·76	13 02	....	Miss E. Davidson; genuine.
.....	.....	.....	.....	7·00	3·00	.....	.....	21243	
10·55	0·97	4 40	15 92	11·52	2·94	9 90	24 69		
5·03	1·73	4·59	11·35	6 76	3 79	13·90	18 01	....	Prof. J. T. Donald; according to guarantee.
.....	.....	.....	.....	9·00	5·00	.....	.....	21244	
8·95	0·14	3·83	12·92	9·09	5·99	7·05	39 75		
5·37	1·07	4·14	10·58	6·44	5 62	9·40	25 30	.....	Prof. J. T. Donald; below guarantee in phosphoric acid.
.....	.....	.....	11·00	9·00	2·00	.....	.....	21245	
8·64	1·67	2·55	12·86	10·31	2·76	12·24	23 54		
7·23	1·91	2·31	11·45	9 14	2·27	12·66	25 37	....	Prof. J. T. Donald; according to guarantee.
.....	.....	.....	10·00	8·00	6·00	.....	.....	21246	
7·99	2·69	1·43	11·51	10·08	7·06	15·04	29 92		
6·45	1·54	1·98	9·97	7·99	6·85	10·51	24 85	.....	" "

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name of Brand of Fertilizer.	Nitrogen. Total including that of Nitric Acid or Ammonia if present.	Nitrogen. Total calculated as Ammonia.
1903.					p. c.	p. c.
April 9	21247	Laing Pork Packing Co., Mill St., Montreal.	Vendors	Tankage Fertilizer—		
				As guaranteed	8·33	10·12
				Standard sample (1394)	8·36	10·15
				Sample as sold	6·61	8·03
" 27	21248	Wm. Ewing & Co., McGill Street, Montreal.	Freeman Fert. Co.	Celery and Early Vegetable Manure—		
				As guaranteed		6·00
				Standard sample (1427)	4·48	5·44
				Sample as sold	3·08	3·86
" 27	21249	"	"	Sure Growth—		
				As guaranteed		3·50
				Standard sample (1425)	3·32	4·03
				Sample as sold	3·22	3·91
" 27	21250	"	"	Tankage—		
				As guaranteed		5·00
				Standard sample (1431)	6·16	7·48
				Sample as sold	3·15	3·82
May 6	21251	Keddy & Kenny, Hemmingford, P.Q.	Nichols Chemical Co.	Capelton Superphosphate—		
				As guaranteed		
				Standard sample (1383)	2·09	2·53
				Sample as sold	0·70	0·85
" 6	21252	"	American Agricultural Chemical Co.	Eclipse (Bradley's)—		
				As guaranteed	1·03	1·25
				Standard sample (1403)	1·10	1·42
				Sample as sold	1·48	1·80
April 21	23157	W.P.Peters, Brock St., Kingston.	Albert Thomas Phosphate Co.	Albert Thomas Phosphate—		
				As guaranteed		
				Standard sample (1396)		
				Sample as sold		
" 21	23158	H. Brown & Son, King St., Brockville.	American Agricultural Chemical Co.	Potato Fertilizer—		
				As guaranteed	2·06	2·50
				Standard sample (1405)	2·07	2·51
				Sample as sold	3.25	3·95
" 21	23159	"	" "	New Method Fertilizer—		
				As guaranteed	1·03	1·25
				Standard sample (1406)	1·22	1·47
				Sample as sold	2·31	2·81
" 21	23160	"	" "	B. D. Seafowl Guano—		
				As guaranteed	2·06	2·50
				Standard sample (1437)	2·78	3·38
				Sample as sold	2·40	2·91
" 21	23161	A. E. Cameron, Brockville.	Nichols Chemical Co.	Victor Fertilizer—		
				As guaranteed		2·00
				Standard sample (1387)	2·53	3·07
				Sample as sold	2·76	3·35
" 21	23162	"	"	Royal Canadian—		
				As guaranteed		4·00
				Standard sample (1386)	4·21	5·11
				Sample as sold	3·38	4·10
" 22	23163	R. W. Ross & Co., Prescott, Ont.	Read Fert. Co.	Vegetable and Vine—		
				As guaranteed		
				Sample as sold	1·67	2·03
" 22	23164	"	"	Farmer's Friend—		
				As guaranteed		
				Sample as sold	1·55	1·88

SESSIONAL PAPER No. 14

Samples of Fertilizers as sold in 1903—*Continued.*

Results of Analysis.									
Phosphoric Acid.					Potash.	Moisture.	Relative value per ton of 2,000 lbs	Number of Sample.	Name of Analyst and Remarks.
Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.					
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
.....	.....	.....	9·40	.....	.....	.....	.....	21247	
1·28	6·88	1·75	9·91	8·16	0·27	11 96	29 97		
0·35	10·50	2·57	13 42	10·85	0·15	13 18	28 76	...	Prof. J. T. Donald: above guarantee in phosphoric acid; below in ammonia.
.....	.....	.....	9 60	.....	6 00	.....	.....	21248	
3 83	2 89	3 83	10 55	6·72	6 83	11·72	27 75		
2·36	6 88	3·71	12·95	9·24	7·24	11 64	27 12	....	Prof. J. T. Donald; below guarantee in ammonia.
.....	.....	.....	8·00	.....	3·00	.....	.....	21249	
3·32	3·72	4·47	11·51	7·04	3·14	14·50	21 34		
3 00	2·17	4·81	9 99	5·17	2 76	10·85	18 63		Prof. J. T. Donald; according to guarantee.
.....	.....	.....	12·00	.....	.....	.....	.....	21250	
0·63	11·68	3·99	16 30	12·31	.....	4·68	29 59		
2·56	4·79	5 20	12·55	7·35	2·68	11·57	20 27	.. ...	Prof. J. T. Donald; below guarantee in ammonia.
.....	.....	.....	.....	8·00	.....	.....	.....	21251	
8 15	2·57	6 07	16·79	10·72	2 18	11·25	22 15		
5·61	0·68	6·03	12·32	6 29	0·15	11·41	11 27	.....	Prof. J. T. Donald; below guarantee in available phosphoric acid.
6·00	.....	2·00	10 00	8·00	2 00	.....	.....	21252	
6 40	3 35	3 84	13·59	9·75	2 09	11·10	17 56		
5·03	4·02	2 94	11·99	9·05	1·92	10·65	17 21	....	Prof. J. T. Donald; according to guarantee.
.....	.....	.....	.....	.....	.....	.....	.....	23157	
.....	14·55	4 00	18·55	14·55	.....	0·20	18 80		
.....	13·95	4·48	18 43	13·95	.....	2·70	18 48	....	Prof. E. B. Kenrick; genuine.
5·00	.....	2 00	10·00	8·00	3 00	.....	.....	23158	
6·07	1·39	2 23	10·23	9 00	3·48	13·95	18 46		
5 92	1·72	2 91	10 55	7 64	2·45	10 93	20 88	..	..
6·00	.....	2·00	10·00	8·00	2 00	.....	.....	23159	
6 07	1·48	2·87	10 42	7 55	2·14	13·55	15 18		
6 23	2·69	1 38	10·30	8·92	1 97	9 85	18 93	..	..
6·00	.....	1 00	9·00	8 00	1·50	.....	.....	23160	
6·07	2·76	2 11	10·94	8·83	1·62	14 65	19 88		
5 81	3·37	2 51	11·69	9·18	1 83	11·46	19 59	..	..
.....	.....	.....	7 00	3·00	.....	.....	.....	23161	
10 55	0·97	4·40	15 92	11·52	2·94	9·90	24 69		
4 80	1·02	5·46	11 28	5·82	3·15	10·00	19 01	..	..
.....	.....	.....	9 60	5·00	.....	.....	.....	23162	
8·95	0·14	3·83	12·92	9 09	5·99	7·05	29 28		
4·72	1·54	5 02	11 28	6·26	7·61	7·94	25 64	...	Prof. E. B. Kenrick genuine.
Not registered under this name.									
.....	.....	.....	.....	.....	.....	.....	.....	23163	
5·95	2·96	2·50	11·41	8·91	5·47	10 15	21 23	...	Prof. E. B. Kenrick.
Not registered under this name.									
.....	.....	.....	.....	.....	.....	.....	.....	23164	
7·08	2·81	3·17	13·06	9·89	3 81	10·92	20 57	.	..

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Samples.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name or Brand of Fertilizer.	Nitrogen.	
					Total including that of Nitric Acid or Ammonia if present.	Total calculated as Ammonia.
1903.					p. c.	p. c.
April 22	23165	R. W. Ross & Co., Prescott, Ont.	Read Fert. Co.....	Standard		
				As guaranteed	0 82	1·00
				Standard sample (1408)....	1·19	1·45
				Sample as sold.....	1·12	1·36
" 22	23166	" ..	"	Potato Special—		
				As guaranteed	0·82	1·00
				Standard sample (1409)....	1·06	1·29
				Sample as sold.....	1·12	1·36
" 18	23109	Titterington & Co., King Street, St. Catharines, Ont.	American Agricultural Chemical Co.	Special No. 1	.....	.....
				Sample as sold.....	1·90	2·31
" 18	23110	" ..	" " .	Complete Manure—		
				As guaranteed	3·29	4·00
				Standard sample (1438)....	4·14	5·03
				Sample as sold.....	2·89	3·51
" 18	23111	" ..	" " ..	Potato Fertilizer—		
				As guaranteed	2·06	2·50
				Standard sample (1405)....	2·07	2·51
				Sample as sold.....	2·13	2·58
" 18	23112	" ..	" " ..	Seafowl Guano—		
				As guaranteed	2·06	2·50
				Standard sample (1437)....	2·78	3·38
				Sample as sold.....	3·49	4·23
" 18	23113	R. R. Gage, St. Catharines.	Freeman Fert. Co., Hamilton.	Sure Growth—		
				As guaranteed	.....	3·50
				Standard sample (1425)....	3·32	4·03
				Sample as sold.....	2·66	3·23
" 18	23114	R. R. Gage, St. Catherines, Ont.	Freeman Fert. Co., Hamilton.	Potato Manure—		
				Asguaranteed.....	.....	3·00
				Standard sample (1430)....	2·95	3·58
				Sample as sold	2·68	3·26
" 16	23441	Wm. Taylor, Barrie, Ont.	" ..	Bone Meal—		
				As guaranteed	.....	3·00
				Standard sample (1433)...	3·50	4·25
				Sample as sold.....	5·08	6·17
" 16	23442	Wm. Taylor, Barrie, Ont.	Imported.	Thomas Phosphate Powder—		
				As guaranteed	....	.....
				Standard sample (1396)....	.....	.....
				Sample as sold	....	...
" 17	23443	J. A. Bruce & Co., King St., Hamilton.	American Chemical Agricultural Co., N. Y.	Bone Dust—		
				As guaranteed	2·50	3·00
				Standard sample (1407) ...	2·78	3·38
				Sample as sold	2·24	2·72
" 17	23444	" .	G. C. Watson, Philadelphia.	Peruvian Guano Flower Fertiliser.	.....	.....
				Sample as sold.....	2·10	2·55
" 16	22068	Halman & Co., Berlin.	Armour & Co., Chicago.	Meatmeal Fertilizer	.....	.....
				Sample as sold.....	8·44	10·25
" 17	22073	Struther & Church, Galt.	.....	Thomas Phosphate Fertilizer—		
				As guaranteed	.....	.....
				Standard sample (1396)....	.....	.....
				Sample as sold.....	.....	.....
" 21	22083	Morton & Christy, Windsor, Ont.	Michigan Carbon Works, Detroit, U.S.	Fertiliser	.....	.....
				Sample as sold..... .	2·84	3·45

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Samples of Fertilizers as sold in 1903—*Concluded.*

Results of Analysis.									
Phosphoric Acid.									
Soluble in Water.	Citric Soluble.	In-soluble.	Total.	Total Available.	Potash.	Moisture.	Relative value per ton of 2,000 lbs.	No. of Sample.	Name of Analyst and Remarks.
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
5·00	.....	2·00	10·00	8·00	4·00	.....	.....	23165	
5·11	4·17	3 35	12·63	9·28	4·48	12·16	19 51		
6·33	2 53	2·13	10·99	8·86	4·27	9·72	18 41	.	Prof. E. B. Kenrick; genuine.
2·00	.....	1·00	5·00	4·00	8·00	.....	.....	23166	
3·99	2·41	2·07	8 47	6·40	8·69	6·04	19 95		
2·61	1·70	1·74	6·05	4·31	8·03	7·10	16 86	....	
Not registered under this name.								23109	
6 24	2·44	3·35	11·83	8·48	7·87	10·16	24 32	.	Miss E. Davidson.
6·00	.....	1 00	9·00	8·00	7·00	.....	.....	23110	
5·75	2·89	2·55	11·19	8·64	7·10	9·35	29 30		
5·28	4 62	3·36	13·26	9·90	9·10	8·00	29 49	....	Miss E. Davidson; unadulterated.
5·00	.....	2·00	10·00	8 00	3·00	.....	.....	23111	
6 07	1·39	2·23	10·23	9 00	3·48	13·95	18 46		
6·88	3·04	1·75	11·67	9·92	6·36	11·06	24 34	....	"
6·00	.....	1·00	9·00	8·00	1·50	.....	.....	23112	
6 07	2·76	2·11	10·94	8·83	1·62	14·65	19 88		
3 36	4·47	4·00	11·83	7 83	2·62	9·60	21 97	....	"
.....	.....	.....	8·00	.....	3·00	.....	.....	23113	
3·32	3·72	4·47	11·51	7·04	3·14	14·50	21 34		
4 48	2·88	5·43	12·79	7·36	3·98	12·76	21 28	..	"
.....	.....	.....	9·00	.....	5·00	.....	.....	23114	
4 31	3·53	4·79	12·63	7 84	7·54	13·16	26 08		
4·79	3·66	5 75	14·20	8·45	3·14	13·60	21 77	....	Alph. Lemoine; deficient in potash.
.....	.....	.....	23·00	.....	.....	.....	.....	23441	
None.	13·24	13·56	26·80	13·24	None.	6·90	27 13		
0·70	11·89	8·31	20 90	12·59	.....	6·65	28 60	.....	Alph. Lemoine; genuine.
.....	.....	.....	.....	.....	.....	.....	.....	23442	
.....	14·55	4·00	18 55	14·55	.....	0·20	18 80		
.....	12·80	5·75	18·55	12·80	.....	Trace.	18 10	....	Alph. Lemoine; deficient in available phosphoric acid.
.....	.....	.....	21·00	.....	.....	.....	.....	23443	
Trace.	14·40	9·27	23·67	14·40	.....	4·25	25 29		
2·87	12·49	6 07	21 43	15·36	5·46	5·45	.....	....	Alph. Lemoine; unadulterated.
.....	Not registered...		.....	.....	.....	.....	.....	23444	
.....	15·36	10·55	25·91	15·36	Trace.	5 00	.....	.....	Alph. Lemoine.
.....	Not registered.		.....	.....	.....	.....	.....	22068	
0 50	0·01	0·96	1 47	0·51	2·29	4·30	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	22073	
.....	14 55	4·00	18·55	14 55	.....	0·20	18 80		
.....	14·30	5·20	19·59	14·30	.....	Trace.	19 37	.....	" genuine.
.....	Not registered ..		.....	.....	.....	.....	.....	22083	
3·60	3·16	1·00	7·16	6·16	6·19	9·05	.....	.....	"

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name or Brand of Fertilizer.	Nitrogen.	
					Total, including that of Nitric Acid or Ammonia if present.	Total calculated as Ammonia.
1903.					p. c.	p. c.
April 21	22085	John Geddins, Windsor.	R. Evans, Hamilton.	Ground Bone—		
				As guaranteed	2·50	3·00
				Standard sample (1407)	2·78	3·38
				Sample as sold	2·71	3·29
" 23	22093	Darch & Hunter, London.	Michigan Carbon Works.	Bonemeal Fertiliser—		
				As guaranteed		1·50
				Standard sample (1474)	1·27	1·54
				Sample as sold	1·91	2·31
" 23	22095	A. McInnis, London.	John McMeghan, Soap Manufacturer	Crown Jewel Fertilizer		
				Sample as sold	8·35	10·14
" 23	22100	Ingersoll Packing Co., Ingersoll.	Vendor	Ingersoll Fertilizer—		
				As guaranteed		9·00
				Standard sample (1434)	7·92	8·40
				Sample as sold	8·00	9·72
" 24	22105	J. H. McMeghan, London.	London Soap Co., London.	Tankage—		
				As guaranteed		
				Standard sample (1435)	9·21	11·18
				Sample as sold	8·19	9·94
" 26	22108	G. Carter & Son, St. Mary's.	Thomas Phosphate Co., England.	Thomas Phosphate Fertilizer—		
				As guaranteed		
				Standard sample (1396)		
				Sample as sold		
" 23	23527	M. J. Henry, Vancouver, B.C,	Importe l	Bone Meal—		
				Standard sample (1463)	2·98	3·62
				Sample as sold	4 56	5·56
" 23	23528	"	Victoria Chemical Co.	Nitrate of Soda—		
				As guaranteed	16·00	
				Standard sample (1480)	15·93	19·35
				Sample as sold	15·94	19·35
" 23	23529	"	"	Sulphate of Potash—		
				As guaranteed		
				Standard sample (1478)		
				Sample as sold		
" 23	23530	"	"	Muriate of Potash—		
				As guaranteed		
				Standard sample (1476)		
				Sample as sold		
" 24	23531	C. Nelson, Vancouver, B.C.	"	Fertilizer B—		
				As guaranteed	3·50	
				Standard sample (1483)	2·79	3·38
				Sample as sold	3 14	3·81
" 25	23536	Victoria Chemical Co., Victoria, B.C	Vendors	Superphosphate—		
				As guaranteed		
				Standard sample (1481)	Trace.	Trace.
				Sample as sold	9·59	0·71
" 25	23537	"	"	Fertilizer "A"—		
				As guaranteed	4·00	
				Standard sample (1482)	3·46	4·20
				Sample as sold	3·00	3 63
25	23538	"	"	Fertilizer "B"		
				As guaranteed	3·56	
				Standard sample (1483)	2·79	3 38
				Sample as sold	3 30	4·00

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Samples of Fertilizers as sold in 1903—*Continued.*

Results of Analysis.									
Phosphoric Acid.									
Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.	Potash.	Moisture.	Relative value per ton of 2,000 lbs	No. of Sample.	Name of Analyst and Remarks.
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
.....	.....	.....	21·00	.....	.....	.....	.....	22085	
Trace.	14·40	9·27	23·67	14·40	.....	4·25	25 29		
Trace.	15·33	9·27	24·60	15·33	Trace.	5·10	26 11	.....	Alph. Lemoine; genuine.
.....	.....	.....	25·00	.....	.....	.....	.....	2_093	
None.	17·01	15·99	33·00	17·01	Trace.	2·75	26 56		
.....	18·85	13·43	31·98	18 55	.....	3·08	25 31	.....	Miss E. Davidson; genuine.
.....	Not registered ..		.....	.....	.....	.....	.....	22095	
2 08	2·57	2·71	7 36	4 65	0·50	6·64	.....	.....	"
.....	.....	.....	6 80	.....	.....	8·00	.....	22100	
Trace.	11·84	2·36	14·20	11·84	0·20	15·12	32 94		
Trace.	10·24	2·39	12·63	10·24	0·44	13 08	31 66	..	" unadulterated.
.....	.....	.....	.....	.....	.....	.....	.....	22105	
Trace.	1·27	2·23	3·60	1·27	0 30	11·75	26 33		
Trace.	4·96	1·76	6·72	4·96	0·32	6·08	25 99	.....	" "
.....	.....	.....	.....	.....	.....	.....	.....	22108	
.....	14·55	4·00	18·55	14·55	.....	0·20	18 80		
.....	13·27	4·32	17·59	13·27	.....	6·64	17 62	.....	" "
Trace.	15·66	10·39	26·05	0·66	.....	8·75	27·50	23527	
.....	15·00	9·50	24·50	15·00	None.	6·20	30 29	...	Dr. C. J Fagan; genuine.
.....	.....	.....	.....	.....	.....	0·65	41 42	23528	
.....	.....	.....	.....	.....	.....	1·76	41 44		
.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	53·00	.....	.....	23529	
.....	.....	.....	.....	.....	53·46	6·00	56 13		
.....	.....	.....	.....	.....	50·30	2·22	52 81	.....	
.....	.....	.....	.....	.....	53·00	.....	.....	23530	
.....	.....	.....	.....	.....	55·58	0·12	58 36		
.....	.....	.....	.....	.....	56·87	2·44	59 69	.....	"
.....	.....	.....	9·00	.....	11·00	.....	.....	23531	
10·23	1·60	.....	11·83	11·83	12·03	9·40	33 92		
10·80	0·50	0·50	11·80	11·30	13·96	7·22	36 48	..	"
.....	.....	.....	16·00	.....	.....	.....	.....	23536	
16 12	2·56	0·64	19·32	18·68	.....	12·70	22 35		
16 00	0·30	0·30	16·60	16·30	None.	14·50	44 55	...	
.....	.....	.....	10·00	.....	7·00	.....	.....	23537	
10·55	0·96	0·64	12·15	11·51	7·51	10·07	30 79		
10·40	0·30	0·30	11 00	10·70	11 81	12·16	33 10	...	" but very badly mixed, large lumps of nitrate of potash being present.
.....	.....	.....	9·00	.....	11·00	.....	.....	23538	
10·23	1 60	.....	11·83	11·83	12·03	9·40	33 92		
9 60	0·20	0 25	10·15	9 90	12 00	13·30	33 10	...	Dr. C. J. Fagan; genuine, but badly mixed.

TABLE II.—Results of the Examination of 84

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher as given by Vendor.	Name or Brand of Fertilizer.	Nitrogen.	
					Total including that of Nitric Acid or Ammonia if present.	Total calculated as Ammonia.
1903.					p. c.	p. c.
April 25	23539	Victoria Chemical Co., Victoria, B.C	Vendor.	Fertilizer "C"		
				As guaranteed.		
				Standard sample (1484)		
				Sample as sold	0·75	0·91
" 25	23540	" . .	"	Thomas Phosphate—		
				As guaranteed.		
				Standard sample (1479)		
				Sample as sold	None.	None.

SESSIONAL PAPER No. 14

Samples of Fertilizers as sold in 1903—*Concluded.*

Results of Analysis.									
Phosphoric Acid.									
Soluble in Water.	Citric Soluble.	Insoluble.	Total.	Total Available.	Potash.	Moisture.	Relative value per ton of 2,000 lbs.	No. of Sample.	Name of Analyst and Remarks.
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	$ cts.		
.....	.....	.....	12·50	.....	11·00	.....	.....	23539	
14·52	1·47	.....	15·99	15·99	11·56	9·10	31 16		
13·10	0·40	0·30	13·80	13·50	11·43	12·56	30 20		Dr. C. J. Fagan; genuine but badly mixed.
.....	.....	.....	15·00	.....	.....	.....	.....	23540	
.....	12·47	4·31	16·78	12·47	.....	0·04	16 74		
None.	11·40	3·60	15·00	11·40	None.	0·28	15 06		Dr. C. J. Fagan; genuine.

MEMORANDA ON MANURES.

Since this publication is intended for circulation among our farmers, it has been thought advisable to take advantage of its issue by reprinting some of the notes which have appeared in former bulletins, and adding a few additional particulars from works which have recently appeared, regarding the application of natural manures and artificial fertilizers.

It is about fifty years since Stoeckhardt, at that time professor in the agricultural school of Tharandt, Saxony, said that a farmer who bought guano, bonemeal, or other artificial fertilizers, and at the same time neglected to make proper use of the dung of the cattle on his own farm, must be regarded as an agricultural spendthrift. Every intelligent farmer in Canada will in these modern days agree with the old German professor, and maintain that the treasury of the farm is the dungstead, and that leaks and emanations from it of valuable fertilizing constituents must lead to financial embarrassment and possibly ruin.

This statement may be positively made without in the slightest degree detracting from the merits of artificial fertilizers, for when properly selected and applied, their value becomes abundantly evident. The question as to whether their use is remunerative has been frequently discussed, and depends to a large extent on the care employed in their selection. Supposing that the intelligent farmer has considered composition, cost, &c., to the best of his ability, made his selection and applied the fertilizer, he may still be in doubt as regards the result unless he takes steps to make a manure trial with it. As regards the best way of doing this, Hellriegel, in a publication, dated 1897, has related his experience. He recognizes how difficult it is for practical agriculturists, fully occupied with their regular work, and engaged in meeting all the difficulties caused by workmen, weather and market rates, to carry out regularly planned manure experiments. He therefore describes a method which experience in his estimation had justified, and recommends it for the purpose of ascertaining whether any application of lime, marl, dung or fertilizers had really produced the improvement which from the point of view of cost had been expected. This plan is to pass over, at one or several places, properly selected, a few square rods of the field without applying the dung or fertilizer. In this way unmanured plots, which do not require to be measured with great exactitude, but merely paced, and do not need to be harvested separately, are left in the manured field, by means of which any improvement in the latter may be remarked and valued.

This plan exacts that it should be possible to *see* a distinct difference between the unmanured plots and the manured field, not only as regards the height and density of the resulting crop, but also in reference to the fullness of the ears and the development of the grains. In the event of such a distinct difference being invisible the manure is justly discredited as unfit for its intended purpose. It would seem advisable to recommend this plan to farmers who use fertilizers, because some of them may manure the whole field, fail to see any improvement on account of being unable to make comparisons, and perhaps condemn the fertilizer unjustly. The simplicity of the plan above described, and its applicability everywhere and every year would appear to commend it to the practical agriculturist. At the same time it is necessary to remark that there are instances on record of fertilizers having been applied and remaining utterly without effect owing to some defect in the soil. Such defects have often been cured by a previous application of marl or lime, which not only produced good effects themselves, but improved also the action of the fertilizers afterwards applied.

THE CARE OF NITROGEN.

This element is the most valuable of fertilizing constituents, and one which is exceedingly liable to loss.

In many of the fertilizers described in this and former reports their cost is very much increased by the admixture of nitrogenous constituents. This cost farmers might save by properly caring for the stock of nitrogen on their farms, and this stock might even be increased by cultivating those crops which have the power of appropriating the

nitrogen of the atmosphere. Nevertheless the fertilizer manufacturers still seem to be under the necessity of supplying this element in considerable quantity in their goods, and of charging for it. In the case of the mixed fertilizers, this extra charge varies from $8 to $14 per ton, which the farmer must pay if he purchases, and which he can readily save in his own stables or produce upon his own farm.

Nearly the whole of the nitrogen in the fodder fed to farm stock is to be found in the excreta of the animals, and one-half of it is contained in the urine. It is further well known that 95 per cent of the potash contained in the food of cattle and sheep may be recovered by carefully saving the liquid manure only. It has, however, been ascertained that stable-yard manure experiences considerable loss of its fertilizing constituents, but more especially of nitrogen, when left to itself in the dung heap. According to the experiments of Wolff, this loss amounts to 55 per cent of the nitrogen contained in fresh manure from horned cattle. The later experiments of Heiden and Holdefleiss place it at 23·4 per cent. These results were obtained when ordinary reasonable care is taken of the manure, but give no data for estimating the loss which occurs when, as is very frequently the case in Canada, the manure is treated with the grossest neglect. It is safe to assume that, generally, 50 per cent of the nitrogen contained in the barn-yard manure of this country returns unutilized to the atmosphere, or is otherwise lost by careless treatment. Supposing that an average quantity of 36,000 pounds is produced in fresh condition annually by each animal, and that it contains 0·4 per cent of nitrogen, it follows that a loss of 72 pounds of nitrogen, worth $8.64, takes place for each head of cattle. This loss can be prevented by daily strewing the stables with two pounds of ground plaster for each animal, which at once prevents any smell of ammonia from arising in the stable. The quantity prescribed means 700 lbs. or a cost of about $2.50 annually for each 1,000 lbs. live weight, but, by adopting this plan, the farmer would to a great extent be relieved from the necessity of purchasing the nitrogen of artificial fertilizers.

In a pamphlet published by Vieweg, 1859, entitled *Ein Pfund Stickstoff kaum einen Groschen*, which may be freely translated 'A pound of nitrogen for a penny,' Dr. Meyer Altenberg maintained that ground gypsum is the very best preservative of barn-yard manure when applied in the stable, because it secures 'certainty and completeness of effect, ease of execution, and the lowest possible cost.' He further described the effect of its application on the domain of Beberbeck in Hesse, and other impoverished farms, showing that it is possible to bring such into a fertile condition without the purchase of manure or fertilizers or feeding stuffs, excepting a little straw for bedding and oats for the horses.

TREATMENT OF STABLE-YARD MANURE.

Dr. Meyer-Altenberg, in the little work above mentioned, takes care to point out that the use of gypsum, without subsequent careful treatment of the dungheaps, does not give the desired effect, and he dwells on the importance of having the manure thoroughly trodden down, and made as compact as possible. This is also shown in Dr. J. Koënig's prize essay, 'How can the farmer preserve and increase the stock of nitrogen on his property?' (Berlin, 1887.) In a special chapter of this work the author discusses 'The evolution of free nitrogen during the fermentation and storage of stable manure,' describes the experiments which were made from 1860 to 1885 regarding its treatment, and gives, finally, the results of the discussion from which the following sentences may be translated with advantage :—

1. In the decomposition of nitrogenous substances of every nature a loss, more or less considerable, of free nitrogen takes place.

2. This loss is the greater the more the atmosphere has access to the decomposing mass.

3. Too much moisture is just as hurtful as too little. Stable manure require such a degree of humidity as permits its components to lie close to each other.

4. The addition of substances which fix ammonia (such as gypsum, kainite and kieserite) prevent or reduce the loss of nitrogen. *These substances are, however, of little*

or no value if care is not taken at the same time to prevent as much as possible the access of air.

12. In storing stable manure in dungsteads the latter must be watertight and roofed in, and the treading down of their contents by the farm animals is to be recommended.

One thing in connection with this question is perfectly certain and that is that the use of gypsum, or ordinary ground land plaster, prevents any loss of nitrogen in the stable, and while the manure is being forwarded to the dungheap. Further, if the work from which the foregoing quotations have been made be carefully studied, and also the experiments and writings of Holdefleiss, Vogel and others, it appears to be quite certain that the use of the same article, or of the gypsum produced in the manufacture of 'acid-phosphate,' completely prevents the loss of ammonia from the liquid part of the manure, and also from the organic nitrogen of the solids, provided the whole has, previous to fermentation, been made thoroughly compact, and atmospheric air almost completely excluded. Where it is found impossible to attend to the latter precautions, the safest way will probably be found to lie in avoiding fermentation altogether, by conveying the fresh manure, after treatment with gypsum, on to the field to be manured and bringing it under the soil as rapidly as possible. The latter practice has been proved to be most advantageous by the experiments which have been carried on for some time past, at the Central Experimental Farm by Director Saunders. (See Reports for 1898.)

Not only has the addition of substances which have the faculty of fixing ammonia been recommended for stable manure, but its improvement to a greater extent has been proposed by the addition of fertilizers. The following quotation is taken from Bulletin No. 45 (for March, 1897) of the Massachusetts Agricultural College, and was written by Dr. C. A. Goessmann, Chemist for that institution :—

'*The practice of adding to the manurial refuse materials of the farm as stable manure, vegetable compost, &c., such single commercial munurial substances as will enrich them in the direction desirable for any particular crop to be raised, does not yet receive that degree of general attention which it deserves.*' (The italics are in the original.) An addition of potash in the form of muriate or sulphate of potash, or of phosphoric acid in the form of fine ground South Carolina or Florida soft phosphate, &c., will in many instances not only improve their general fitness as complete manure, but quite frequently permit a material reduction in the amount of barn-yard manure ordinarily considered sufficient to secure satisfactory results.'

'Average composition of seventy-five samples of barn-yard manure :—

	Per cent.	Lbs. per ton.
Moisture	67·00	1,340·0
Nitrogen	0·52	10·4
Potassium oxide	0·56	11·2
Phosphoric acid	0·39	7·8

The average barn-yard manure contains, it will be noticed from the above statement, a larger percentage of nitrogen, as compared with its potash and phosphorie acid than is generally considered economical. An addition of from thirty to forty pounds of muriate of potash, and of one hundred pounds of fine ground natural phosphate (soft Florida or South Carolina floats) per ton of barn-yard manure would greatly increase its value as an efficient and economical general fertilizer.'

These are no doubt most excellent suggestions, and there is no reason why these substances should not be introduced into the stable manure in the same manner as in the case of the ground plaster above mentioned. Plain superphosphate and kainite might also be used, some of the constituents which would be useful in fixing the ammonia, as soon as formed from the organic nitrogen. Should this suggestion be found to have practical value, there is no doubt that our fertilizer manufacturers would be found able to supply our farmers, at a moderate coat, with a mixture of ground plaster, superphosphate and kainite, in such proportions as experience might show to be most advantageous. No better application can be made of the wood ashes produced in the

farmer's household than by mixing them with the barn-yard manure, and most excellent results are known to have followed this practice.

ACQUISITION OF NITROGEN.

Not only can the farmer save almost the whole of the nitrogen contained in the fodder fed to his cattle, but he can actually increase the stock of it stored away in his fields, agricultural products and manure heaps, by a judicious course of crop rotation. For more than a century agricultural chemists have discussed the question as to whether free atmopheric nitrogen can be assimilated by plants, but it may now be regarded as perfectly settled in the affirmative, if regard is had only to the plants of the order leguminosæ, such as beans, pease, lentils, vetches, clovers, alfalfa, serradella, &c. Even the great English agriculturists, Sir J. B. Lawes and Sir Henry Gilbert, who had previously bæn of an opposite opinion, have now admitted that this appropriation of nitrogen has been completely proved. This acknowledgment was made by Sir Henry Gilbert, at a great meeting of agricultural chemists held at Halle, in Germany, in September, 1891. Thus, modern research has confirmed not only modern agricultural practice, but also the experience of antiquity, for Prof. W. Strecker has pointed out a passage in Pliny which says : 'Lupines require so little manure that they, in fact, replace it ; vetches make the land more fertile. Corn should be sown where previously lupines or vetches have stood, because they enrich the land.'

It is not, however, to be supposed that this utilization of atmospheric nitrogen by leguminous plants can take place upon very poor soils or upon those destitute of the inorganic constituents which they require. The latter must in such cases be supplied in the shape of potash with some phosphoric acid, as was done with great success by Schultz, of Lupitz, a practical agriculturist in North Germany. In fact, had it not been for his investigations, the controversy above referred to might have contained without results up to the present hour.

Professor König, of Münster, gives the following summary of Schultz's experience :—

'Schultz acquired the farm Lupitz in the year 1855 ; its soil consisted of a poor, cold diluvial sand ; the profit in working it was very small. Lupines yielded, indeed, as a fodder tolerable results, but when used as green manuring for rye and oats, no return was obtained from them. The application of artificial manures produced good crops, bnt they did not pay ; burnt lime showed itself to be too heating. The use of manure was more favourable, especially when fertilizers containing phosphoric acid were used at the same time. But at the best the total result was not satisfactory.

'Shortly after Schultz acquired Lupitz, the great discovery of potash salts was made, and about 1860 they began to be produced from the mines of Stassfurth. Schultz made up his mind to try them as manure and he obtained the most surprising results. After lupines had shown themselves to be useless as forerunners of grain, they were excluded from the rotation and grown on a separate field without any manuring and alternating with sheep pasture. But the harvest on these became worse and worse until the field in question became quite lupine "sick." Schultz made his first trial on this field, manuring it with 300 pounds kainite per morgen (1 Prussian morgen = 0·631 acre) ; the sickness was at once cured, and for twenty-five years afterwards Schultz has grown lupines on this ground without interruption, always with the application of 300 pounds kainite. Schultz obtained similar good results on the ground which had received the marl, by the application of potash salts. This ground had indeed yielded well with lupines for two years after the application of the marl, but in the third year they sickened here too. When, however, 300 pounds kainite were applied here and ploughed in, the ground was cured, although an application of phosphates had not produced the desired results.

'The favourable influence which the manuring with kainite or potash salts had exerted on lupines induced Schultz to try them on grain, in conjunction with phosphates. But in this case he obtained contradictory results, according to the nature of the crops which preceded the grain. For instance, while grain sowed after lupines and manured with potash and phosphates yielded very good and remunerative harvests, these were not

to be obtained if grain was grown after grain or after potatoes. This behaviour of these crops was explained by Schultz in this way : that lupines or deep-rooted plants leave in the soil after harvest a residue of root, in which a considerable amount of nitrogen has accumulated, an amount sufficient to supply the wants of the following grain crops ; that, on the other hand, the application of potash and phosphates, to grain, after a preceding grain crop, is without effect, for the reason that the latter has consumed the stock of nitrogen. Grain crops always reduce this stock ; never increase it. Schultz has given the name of "nitrogen collectors" to the lupines and similar plants, while grains are called "nitrogen consumers." His system of rotation is therefore the following :—Sow first nitrogen collectors (lupines, pease, beans, vetches, clover, lucerne, serradella, &c.), or, as they have been called, renovating crops, and give them 300 pounds kainite per morgen, with perhaps an addition 20 pounds phosphoric acid. After harvesting the nitrogen collectors, sow a nitrogen consumer, raising a grain or exhausting crop, giving it also 300 pounds kainite and 20 pounds phosphoric acid. The grain crop is perfectly successful, because the first crop left behind it nitrogen enough to supply the wants of the grain. In this way the keeping of stock, which is expensive on a poor sandy soil, can be reduced and the purchase of nitrogenous fertilizers dispensed with, because the nitrogen collectors are able to stock the soil with that valuable element.'

The foregoing description is taken from Professor König's 'Stickstoff Vorrath,' published in 1887 (Paul Parey, Berlin). It was in 1884, nearly thirty years after the purchase of his sandy farm, that Schultz, of Lupitz, published the results of his experience, although they did not contain anything very new and although they only confirmed experiences still older than his own. But his case was surprising and his explanation of the cause of his successful farming challenged the attention of scientific agriculturists. The consequence has been the issue of many pamphlets on the subject, and an activity in the region of agricultural experimenting which is not yet ended. Atwater, Wagner, Heiden, Hellriegel and many others have participated in these investigations, and Professor Wood, of the Storrs Agricultural School in Connecticut, has given the following general conclusions as the result of the work :—

1. 'Pease, alfalfa, serradella, lupine, clover in all probability, and apparently leguminous plants in general, are able to acquire large quantities of nitrogen from the air during their period of growth.

2. 'There is scarcely room to doubt that the free nitrogen of the air is thus acquired by plants.

3. 'That is a connection between root tubercles and this acquisition of nitrogen is clearly demonstrated. What this connection is, what are the relations of micro-organisms to the root tubercles and the acquisition of nitrogen, and in general how the nitrogen is obtained are questions still to be solved.

4. 'The cereals with which the experiments have been completed have not manifested this power of acquiring nitrogen, nor do they have such tubercles as are found on the roots of legumes.

5. 'In the experiments here reported, the addition of soil infusions did not seem necessary for the production of root tubercles. A plausible supposition is that the micro-organisms or their spores were floating in the air and were deposited in the pots in which the plants grew.

6. 'As a rule the greater the abundance of root tubercles in these experiments, the larger and more vigorous were the plants and the greater was the gain of nitrogen from the air.

7. 'In a number of these experiments, as in similar ones previously reported, there was a loss of nitrogen instead of gain. The loss occurred where there were no root tubercles : it was especially large with oat plants, and largest where they had the most nitrogen at their disposal in the form of nitrates. As the gain of nitrogen by the legumes helps explain why they act as renovating crops, the loss in the case of the oats suggests a possible reason why they should appear to be an exhausting crop.

'Practical inferences :—The ability of legumes to gather nitrogen from the air helps to explain the usefulness of clover, alfalfa, pease, beans, vetches and cow pease as renovating crops, and enforces the importance of these crops to restore fertility to exhausted

soils. The judicious use of mineral fertilizers (containing phosphoric acid, potash and lime) will enable the farmer to grow crops of legumes which, after being fed to his stock, will, with proper care to collect and preserve all manure, both liquid and solid, enable him to return a complete fertilizer in the shape of a barn-yard manure to his land. A further advantage of growing these crops is that the nitrogenous material, protein, which they contain in such great abundance, is especially valuable for fodder.'

From the foregoing it seems that, in the present condition of our knowledge, the conclusion may be drawn that the atmosphere stands ready to furnish the farmer, gratis, with all the organic constituents which his crops require, provided always that he, on his part, will exercise a sufficient amount of skill and intelligence in approaching and retaining on his farm the fertilizing materials, and especially the nitrogen. If he does this, all that is necessary for him to provide, in order to replace the losses which his farm sustains from the sale of stock or produce, are the inorganic or mineral constituents of these, and especially the phosphoric acid and potash. There is much in all this to remind one of Sprengel and Liebigs teaching of fifty years ago, according to which a plant cannot thrive if its soil does not contain all the substances which are to be found in its ash.

UTILIZATION OF SEWAGE.

The losses in fertilizing material which are sustained, as above mentioned, on account of the neglect or unscientific treatment of barn-yard manure, are very trifling when compared with those which the community suffers in the almost total loss of the nitrogen, phosphoric acid and potash contained in human excreta. The utilization of such always becomes a subject for discussion when the question is raised as to how a cheaper class of manures than the artificial fertilizers can be obtained for use in agriculture.

Where the water carriage system of removing sewage and excrement has been introduced, nothing is to be hoped for in the recovery of their fertilizing constituents. Even in cases where, at large expense, establishments have been erected for the treatment of sewage by precipitation or similar methods, the products have been found to be entirely destitute of agricultural value. The greater part of the fertilizing constituents of sewage are in such a soluble condition, and have been diluted with water to such an extent, as to render their recovery economically impossible. It has been attempted in the neighbourhood of many cities in England and on the continent of Europe to use the sewage for irrigation and as liquid manure, but this method of utilization has been found to be in the highest degree imperfect. At Berlin, it has been proved, that of the nitrogen contained in its sewage, at the very most only 13·8 per cent is found in the agricultural products of all the magnificent farms irrigated by it in the neighbourhood of the city. When the use of water for removing house refuse is excluded, and ordure and urine are removed as manure in their natural state, their utilization is possible, and is made a source of revenue in such towns as Stuttgart, Groningen, Greifswald, &c. But the systems of this class which are in use have all their disadvantages, as is proved by the tendency which municipal authorities constantly show to adopt the water carriage system. The greatest disadvantage under which these systems labour is the difficulty caused by the offensiveness to sight and smell of the material with which they have to deal. This has been entirely met by the use of moss litter as an absorbent, deodorizer, and disinfectant.

MOSS MANURE.

The first public mention of the usefulness of moss litter as a deodorizer and absorbent seems to have been made by Dr. Ludwig Happe, in Braunschweig, in December 1880, since which time its application for the purpose has gradually increased until now, when the system has been introduced into several towns in Germany, and is also practised in Congleton, Cheshire, England. In Canada this method of deodorizing human refuse has been in use for years at Caledonia Springs. It, of course at once recalls

the dry earth system regarding which great expectations were at one time entertained. The advantages of moss litter over dry earth for the purposes in question are, however, very decided. They consist in the perfect inoffensiveness of the moss litter product, in the fact that one part of moss litter will deodorize and dry at least six parts of mixed excreta, and in the greater agricultural value of the resulting manure. Dry earth (which is required in quantity at least equal to that of the excreta) is valueless from an agricultural point of view, but this is not the case with moss litter, which, as its analyses show, often contains as much nitrogen as ordinary barn-yard manure. Numerous analyses have been made of moss litter manure as produced in Germany, and its average contents from seven difierent towns may here be stated.

	p. cent.	lbs. per ton.		Value per ton.
Nitrogen	0·644	13·28	at 13c.	$1 72
Phosphoric acid	0·350	7·00	5	0 35
Potash	0·285	5·70	5¼	0 30
Water	83·00			$2 37

Numerous trials have been made on various crops with this manure, and very satisfactory results are always reported. In all cases it is stated to excel barn-yard manure even when the latter is used in much greater quantity.

In a paper read before the Royal Society of Canada, on May 27, 1902, Mr. T. Macfarlane describes a manner of applying the moss litter, by means of which the quantity used is much reduced, and the value of the resulting manure greatly increased.

Canada possesses in its bogs and swamps inexhaustible quantities of moss litter, which is frequently found in beds several feet in thickness lying above the peat. The following tests have been made in the Inland Revenue Laboratory of moss litter from various localities in the Dominion :—

	Moisture.	Ash.	Nitrogen.
	Per cent.	Per cent.	Per cent.
Moss litter, Berwick, N.S.	14·40	1·16	1·26
Black muck "	13·30	3·68	1·58
Moss from Great Village, N.S.	63·44	3·46	0·63
Sphagnum moss from Shippegan, N.B.	12·45	1·55	0·55
Light coloured moss litter from Lincoln Parish, N.B	11·55	1·40	1·79
Dark coloured sample from the foregoing locality	10·95	0·80	1·06
Moss litter from Musquash, N.B., upper layer	11·50	0·95	0·82
Moss litter from same locality, lower layer	12·50	0·90	0·72
Peat from St. Bridget, Province of Quebec	13·30	2·50	1·48
Peat from St. Hubert, Quebec	12·35	2·68	1·84
Light coloured moss litter from Caledonia Springs	10·00	1·60	2·95
Dark coloured moss litter from same locality	11·60	2·70	2·28
Peat from the same locality	10·05	3·90	2·94
Surface moss from the Mer Bleu at Eastman's	10·85	2·80	0·71
Surface moss from the Mer Bleu at Baldwin's Farm	7·90	2·66	1·47
Surface moss from the Mer Bleu at Baldwin's Farm, 18 inches deep.	27·90	1·72	1·64
Peat from Mer Bleu at McFadden's Farm, wide ditch, Navan	22·60	4·40	2·21
Peat from Mer Bleu, McFadden's Farm, narrow ditch, Navan	9·40	6·62	2·80
Peat from near Stratford, Ont.	16·80	9·10	1·91
Hypnum moss from near Stratford, Ont.	8·75	9·72	2·01
Moss littter from bog in Welland County, Ont.	3·85	4·70	1·51
Peat lying underneath the foregoing.	5·30	4·85	1·41
Peat from the same locality, lying 4½ feet below surface.	3·25	41·25	1·52
Peat from Dobson's bog, near Beaverton, Ont	18·42	9·04	1·89

The manufacture of moss-litter has been attempted at Musquash, in New Brunswick, and it is now being produced in Welland county, Ontario. From the latter locality I was supplied with several bales of the moss litter for experimental purposes, and Dr. Laberge, of Montreal, undertook to superintend the carrying out of an experiment to determine its deodorizing and absorbent qualities. He reports that 100 lbs. of moss litter were sufficient for drying 800 lbs. of ordinary excreta from privy pits in Montreal, and rendering it entirely inoffensive. A sample of the product remained for days in my office without attracting notice and, indeed, it was quite devoid of odour. Its analysis gave the following results :—

	p. c.	Lbs. per ton.		Value per ton.
Nitrogen	1·31	26·2	at 13c.	$3 41
Phosphoric acid	0·90	18·0	" 5	0 90
Potash	0·14	2·8	" $5\frac{1}{4}$	0 15
Water	65·47			$4 46

The valuation of ordinary fresh barn-yard manure with 75 per cent of water is about $2 per ton; with 67 per cent water as in the case of the average given above by Dr. Gossmann, the value is nearly $2.25. Therefore, much better results might be expected agriculturally from a 'moss manure' of the composition just described.

Moss litter might also be applied with great advantage in public urinals. When a sample of it was supersaturated with urine and dried, and this process repeated several times, no offensive odours were developed and the product was found on analysis to contain 12·41 per cent of nitrogen, which is equal to a valuation of $32.26 per ton.

These facts are reported in order to show that Canada possesses in her waste lands abundance of material which might be used in our towns and villages for the production of a very valuable manure, with the simultaneous introduction of very many sanitary advantages. It is not to be expected that cities or towns which are advantageously situated for the water carriage system. or which have already adopted it, will make any changes, but there are many towns and villages in the Dominion where the application of the moss litter system would be very suitable, and the authorities of which, by selling the product or giving it gratis to the farmers of the neighbourhood, might confer a great benefit on agriculture.

APPENDIX F.

BULLETIN No. 87.--CANNED VEGETABLES.

OTTAWA, July 15, 1903.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR,—I have to transmit herewith enclosed, a report by Mr. McGill on the samples of Canned Vegetables which were collected in accordance with your instructions of March 27 last. The report is accompanied by a tabulated statement which describes the origin of the samples and the results obtained in their examination.

I have the honour to be, sir,
Your obedient servant,
THOMAS MACFARLANE,
Chief Analyst.

OTTAWA, July 14, 1903.

THOS. MACFARLANE, Esq., F.R.S.C., &c.,
Chief Analyst, Inland Revenue Department.

SIR,—I have the honour to hand you herewith a detailed statement of the analysis of 100 samples of canned vegetables. These may be classified as follows :—

	Samples.
Canned peas	27
" corn	28
" tomatoes	14
" beans	20
" carrots	1
" beets	3
" cabbage	1
" asparagus	1
" mushrooms	1
" pumpkin	2
" squash	2
	100

All of these samples were examined for chemical preservatives, but no substances of this nature were detected.

With two exceptions, all the samples were found to be in good condition. The exceptions were samples of corn, one of them (No. 21290) being but slightly decomposed, the other (No. 23135) being quite rotten and offensive.

In addition to the examination just indicated, the samples of peas were submitted to a test for copper.

Copper is stated to be normally present, in traces, in some peas. (Bull. 13, part 8, Department of Agriculture, Washington, 1893). I have determined the degree of accuracy obtainable by the method I used [electrolytic deposition on platinum (sulphuric acidulation) and subsequent solution and colorimetric valuation of the separated copper] and find that less than 10 parts per million can easily be detected, although the quantitative statement of less amounts than this must be accepted with caution, and is best denoted as 'traces'.

Such traces have been found in two samples, No. 17862 and 21716. I have no evidence to show that these traces mean any intentional addition of copper for purposes of intensifying colour. A sample of French peas gave 60 parts of copper per million.

I may add that the question of the wholesomeness of peas greened with copper, is yet unsettled, but the general weight of opinion in English-speaking countries is adverse to the practice.

I have the honour to be, sir,

Your obedient servant,

A. McGILL.

TABLE I.—Analysis of 100 Samples of

Date of Collection.	Nature of Sample.	Number of Sample.	Name and Address of Vendor.	Quantity.	Cost.
1903.			*District of Halifax.*		$ cts.
April 16	Canned pumpkins	20239	F. H. Barteau, Yarmouth	3 bots.	0 30
" 18	" peas	20246	T. L. Harvey, Wolfville	3 "	0 30
" 18	" string beans	20248	W. T. Stephens, Wolfville	3 "	0 30
" 18	" corn	20249	" "	3 "	0 30
" 20	" tomatoes	20252	Murphy & Demont, Windsor, N.S	3 "	0 30
" 20	Wax beans	20259	Wentworth Stores, Ltd., Windsor	3 "	0 30
" 20	Canned squash	20260	" "	3 "	0 30
" 22	" corn	20301	J. H. Kent, Truro	3 "	0 30
" 22	" peas	20302	" "	3 "	0 30
" 22	" peas	20306	Brown & Graham, Halifax	3 "	0 30
" 17	Green peas	4320	Geo. Rackham, Charlottetown	3 "	0 30
" 17	Refugee beans	4322	L. MacNutt, Charlottetown	3 "	0 20
" 20	Wax beans	4332	Brace, McKay & Co., Charlottetown	3 "	0 60
" 22	Canned tomatoes	4336	McDonald & Westang, Georgetown	3 "	0 30
			District of New Brunswick.		
April 13	Canned corn	17861	J. G. Lake, Union St., St. John	3 bots.	0 30
" 13	" peas	17862	W. H. Dobson, 24 Waterloo St., St. John	3 "	0 30
" 14	String beans	17872	Baird & Peters, Ward St., St. John	3 "	0 66
" 16	Tomatoes	17879	Sussex Mercantile Co., Main St., Sussex	3 "	0 36
" 16	Sliced sugar beets	17880	King, Ashbell & Co., Broad St., Sussex	3 "	0 30
" 16	Canned tomatoes	17882	J. A. Humphrey, Maple Ave., Sussex	3 "	0 45
" 18	" pumpkins	17895	G. M. & A. A. Banker, 287 Main St., Moncton	3 "	0 25
" 23	Rhubarb squash	17908	John Graham, Queen St., Woodstock	3 "	0 30
" 23	Sugar corn	17910	E. M. Campbell, Main St., Woodstock	3 "	0 30
" 25	Sugar peas	17915	W. A. Estabrook, Fredericton	3 "	0 27
			District of Quebec.		
April 16	Canned tomatoes	23340	C. Peloquin, St. Hyacinthe	3 cans.	0 37
" 20	" peas	23346	H. Bisaillon, St. Lambert	3 "	0 25
" 22	" peas	23364	R. E. Kelly	3 "	0 30
" 23	" corn	23366	H. Deslauriers, Lachine	3 "	0 30
" 23	" corn	23368	T. J. Ibynnes, Lachine	3 "	0 45
" 29	" corn	23379	Ronald Piette, Berthierville	3 "	0 30
May 1	" tomatoes	23393	Victor Gervais, St. Hyacinthe	3 "	0 45
" 1	" peas	23396	Jos. Leduc, St. Hyacinthe	3 "	0 30
" 14	" peas	23398	P. C. Lemoine, Sorel	3 "	0 25
" 14	Pork and beans	23399	" "	3 "	0 15
" 14	Canned peas	23601	J. O. Fagnan	3 "	0 25
			District of Montreal.		
May 28	Canned corn	21285	A. Archambault, 2,045 St. James St., St. Henri	3 cans.	0 25
" 28	" corn	21286	F. Forest, 210 St. James St., St. Henri	3 "	0 25
" 28	" beans	21287	" " "	3 "	0 25
" 28	Green peas	21288	" " "	3 "	0 25
April 29	Canned tomatoes	21289	A. Laing, 2,023 Notre Dame Street, Montreal	3 "	0 38
May 8	" corn	21290	E. Limoges, 1,949 Notre Dame Street, Montreal	3 "	0 27
" 14	" corn	21291	E. H. Montpetit, 227 Richelieu Street, St. Cunigonde	3 "	0 25
" 14	Green peas	21292	" " " "	3 "	0 30
" 14	Butter beans	21293	" " " "	3 "	0 25
" 14	Canned corn	21294	W. J. Maloney, 468 St. Antoine Street, St. Cunigonde	3 "	0 30

SESSIONAL PAPER No. 14

Canned Vegetables as sold in 1903.

Name and Address of Manufacturer or Furnisher as given by Vendor.	Name of Brand.	Preservatives.	Remarks.
Simcoe Canning Co., Simcoe, Ont.		None	Good.
A. C. Miller, Picton, Ont		"	No copper—well preserved.
W. L. Boulter & Sons, Picton, Ont.		"	Good.
A. B. Saylor, Bloomfield, Ont		"	"
A. C. Miller, Picton, Ont		"	"
Simcoe Canning Co.		"	"
D. W. Hoegg & Co., Fredericton.		"	"
A. C. Miller, Picton, Ont		"	"
" "	Little Chief.	"	No copper—well preserved.
Simcoe Canning Co., Simcoe, Ont.		"	"
"	Lion	"	"
"		"	Good.
"		"	"
"		"	"
D. W. Hoegg & Co., Fredericton.		None	Good.
Maritime Pure Food Co	St. John Valley.	"	Traces of copper—well preserved.
A. B. Saylor, Bloomfield		"	Good.
Reynard & Co., Baltimore	Fox brand	"	"
Simcoe Canning Co., Simcoe, Ont.		"	"
Bloomfield Canning Co		"	"
Delhi Fruit and Canning Co	'Maple Leaf'	"	"
D. W. Hoegg & Co., Fredericton.	'Dominion'	"	"
" "	"	"	"
Bloomfield Canning Co.	Quaker brand	"	No copper—well preserved.
Vendor		None	Good.
Simcoe Canning Co.	Lynn Valley.	"	No copper—well preserved.
A. C. Miller, Picton, Ont		"	"
Miller & Co., Trenton		"	Good.
Martin Laporte & Co., Montreal.		"	"
A. C. Miller & Co., Picton		"	"
Simcoe Canning Co		"	"
Delhi Fruit and Canning Co	Maple Leaf	"	No copper—well preserved.
A. C. Miller & Co., Picton, Ont.		"	"
W. Clark, Montreal		"	Good.
Brighton Canning Co		"	No copper—well preserved.
"	Queen brand	None	Good.
"	Union brand	"	"
"	'Red Cross'	"	"
"	'Maple Leaf'	"	No copper—well preserved.
"	Victoria brand.	"	Good.
"	Star brand	"	Slightly decomposed.
"	Union brand	"	Good.
Lynn Valley		"	No copper—well preserved.
Lake Port Preserving Co		"	Good.
"	'Canada First'	"	Good.

TABLE I.—Analysis of 100 Samples of

Date of Collection.	Nature of Sample.	Number of Sample.	Name and Address of Vendor.	Quantity.	Cost.
1903.			*District of Kingston.*		$ cts.
April 20	Canned wax beans	23131	R. T. Hamly, Walton Street, Port Hope	3 cans.	0 21
" 20	" tomatoes	23132	S. Fourt. " "	3 "	0 38
" 20	" corn	23133	" " "	3 "	0 25
" 20	" sugar corn	23126	W. H. Hamilton, Peterboro'	3 "	0 25
" 20	Green peas	23127	" "	3 "	0 25
" 20	Canned peas	23128	E. Brown & Co., Peterboro'	3 "	0 38
" 20	" peas	23129	" "	3 "	0 38
" 20	" corn	23130	" "	3 "	0 25
" 20	" corn	23135	Ottawa		
			District of Toronto.		
April 15	Canned corn	23411	Chas. Chown, 575 Yonge Street, Toronto	3 "	0 25
" 15	Green peas	23412	" " "	3 "	0 25
" 15	Canned beans	23413	R. English, 490 Yonge Street, Toronto	3 "	0 25
" 15	Sweet peas	23414	F. Patience, 427 Yonge Street, Toronto	3 "	0 25
" 15	Canned corn	23415	" " "	3 "	0 23
" 16	" corn	23416	J. M. Bothwell, Dunlop Street, Barrie	3 "	0 30
" 16	String beans	23417	" " "	3 "	0 30
" 16	Wax beans	23418	James Vair, Dunlop Street, Barrie	3 "	0 30
" 16	Green peas	23419	" " "	3 "	0 30
" 16	Canned tomatoes	23420	" " "	3 "	0 45
			District of Windsor.		
April 13	Golden wax beans	22049	E. O'Flaherty, Stratford	3 "	0 30
" 15	Canned beans	22056	B. B. Gunn, Seaforth	3 "	0 25
" 15	" peas	22057	" "	3 "	0 30
" 15	" corn	22058	" "	3 "	0 30
" 16	" peas	22070	A. K. Roesch, Waterloo,	3 "	0 25
" 18	" corn	22078	Peter Anderson, Guelph	3 "	0 30
" 18	" beans	22079	Jackson & Son, Guelph	3 "	0 30
" 22	" corn	22090	H. Malcomson, Chatham	3 "	0 25
" 23	" tomatoes	22096	James Wilson, London	3 "	0 45
" 23	" tomatoes	22099	Scanchett Bros., London	3 "	0 45
			District of Winnipeg.		
April 15	Canned corn	17429	Jas. Blair Co., Morden		0 30
" 16	Buttered beans	17433	R. Cross Co., Limited, Killarney		0 40
" 18	Canned peas	17439	Hunter, Moore & Aikens, Boissevain		0 40
" 18	" corn	17440	F. G. Fox, Boissevain		0 40
" 21	" tomatoes	17443	McLellan & English, Virden	3 cans.	0 60
" 24	" carrots	17452	Smith & Burton, Brandon	3 "	0 45
" 24	Sugar beets	17451	J. P. Murray & Co., Brandon	3 "	0 45
" 24	Canned cabbage	17453	Smith & Burton, Brandon	3 "	0 45
" 25	" asparagus	17460	T. A. Newman Bros., Portage la Prairie	3 "	1 05
May 6	Mushrooms	17465	J. A. McKercher, Winnipeg	3 "	0 75
			District of Manitoba.		
April 21	Canned corn	21712	Smith & Gaetz, Red Deer	3 cans.	0 45
" 23	Green peas	21716	Compton & Montgomery, Wetaskiwin	3 "	0 40
" 24	Baked beans	21721	J. Whitlaw, Edmonton	3 "	0 45
" 25	Tomatoes	21723	Douglas Bros., Edmonton	3 "	0 50
" 29	String beans	21730	Copas & Emerson, Strathcona	3 "	0 40

SESSIONAL PAPER No. 14

Canned Vegetables as Sold in 1903.—*Continued.*

Name and Address of Manufacturer or Furnisher as given by Vendor.	Name of Brand.	Preservatives.	Remarks.
	'Log Cabin'..	None	Good.
	'White Rose'.		
	Queen brand...		
	'Little Chief'		No copper—well preserved.
	'Extra Faultless'		
	Epicure brand		
	'Log Cabin'..		
Brighton Canning Co.	Thistle....		Much decayed.
	'Favorite brand'		Good.
	'Advance Sweet'		No copper—well preserved.
	Thistle brand...		Good.
Strathroy Packing Co.			No copper—well preserved.
	'Maple Leaf'...		Good.
	'Red Cross'...		
	Quaker brand...		
	'Blue Bell'.....		
	Kitchner brand.		No copper—well preserved.
	Morton brand...		Good.
Oshawa Canning Co.....			Good.
Aylmer Canning Co.	Standard.		Well preserved.
Vendor.....			No copper—well preserved.
Oshawa Canning Co.			Good.
Randal & Roose, Berlin.			No copper—well preserved.
Aylmer Canning Co.			Good.
Oshawa Canning Co.....			
Kent Canning Co.....			
Bloomfield Canning Co..	Quaker brand.		
Indiana Packing Co.....			
Lalor Canning Co.....		None	Good.
Delhi Fruit and Canning Co.....			
Strathroy Canning Co.	Middlesex..		No copper—well preserved.
Kent Canning Co.....			Good.
Balfour & Co., Hamilton.....			
Simcoe Canning Co.....			
Lake Port Preserving Co..			
Simcoe Canning Co.....			
Hickwith Asparagus Canning Co.			
Dandrealle & Gaudin, Bordeaux, France.....			
W. Boulter & Son, Picton, Ont..	.....	None.	Good.
Perth Canning Co.	Royal Standard.		Traces of copper—well preserved
			Good.
Aylmer Canning Co.....			
A. B. Saylor, Bloomfield, Ont			

TABLE I.—Analysis of 100 Samples of

Date of Collection.	Nature of Sample.	Number of Sample.	Name and Address of Vendor.	Quantity.	Cost
1903.			*District of British Columbia.*		S cts.
April 16	Canned peas	21691	Coulter & Berry, Langley, B.C.		0 55
" 18	" beans	23509	Harrison River Mills Timber and Trading Co., British Columbia	3 cans.	0 60
" 18	" tomatoes	23512	M. Desbrisay, Mission, B.C.	2 "	0 30
" 18	" corn	23515	J. Plumridge, Mission, B.C	2 "	0 25
" 18	" peas	23518	S. Petersky, Steveston, B.C.	2 "	0 25
" 18	" corn	23519	" "	2 "	0 25
" 18	" corn	23541	S. Greenhalgh, Victoria, B.C.	3 "	0 45
" 18	" beets	23545	J. R. Jackson, Vancouver	3 "	0 45
" 18	" beans	23546	Foran Bros., Vancouver	3 "	0 30
" 18	" peas	23551	W. P. Pemville, Vancouver	3 "	0 40
" 18	" peas	special			

Canned Vegetables as Sold in 1903.—*Concluded.*

Name and Address of Manufacturer or Furnisher as given by Vendor.	Name of Brand.	Preservatives.	Remarks.
Bloomfield Canning Co.		None	No copper—well preserved.
Brighton Canning Co.		"	Good.
San Bernard Packing Co.		"	"
Kent Canning Co., Chatham, Ont.		"	"
Oshawa Canning Co.	Blue Bell	"	No copper—well preserved.
Strathroy Canning Co		"	Good.
Newton Canning Co.		"	"
Lion Gate Packing Co., Simcoe.		"	"
L. M. Schench & Co., St. Catharines		"	"
Balfour & Co., Hamilton	Tartan	"	No copper—well preserved.
French manufacture		"	Copper—60 parts metallic copper per million (=0·006 per cent)—well preserved.

APPENDIX G.

BULLETIN No. 88. -PARIS GREEN, 1902-3.

OTTAWA, July 31, 1903.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR,—I have to submit herewith a tabulated statement descriptive of the samples of Paris Green which were collected in accordance with your instructions of March 27 last, and also of a smaller collection of the same article made previously, the particulars of which were reported to you on October 27, 1902, but have not yet been published. Taking both collections, the number of samples submitted to examination was as follows: —

In Prince Edward Island	8
Nova Scotia	18
New Brunswick	18
St. Hyacinthe District	18
Montreal "	18
Kingston "	18
Toronto "	16
London "	17
Manitoba and N. W. Territories	20
British Columbia	18
Total	169

Of this total the number of samples pronounced to be adulterated, or challenged for other defects, was as follows:—

	Adulterated.	Challenged.
From Prince Edward Island	2	0
St. Hyacinthe District	1	1
Montreal District	1	0
Toronto "	0	2
	4	3

Discarding all the samples to which objection has been taken (7 out of 169) the percentage of genuine is 95·8. From this result it seems that an improvement has

been taking place during the last ten years in the quality of Paris green sold in the Dominion. The averages of pure samples in the various collections made are given in the following memorandum :—

1894	72·2 p.c. genuine
1895	89·1 p.c. "
1902–3	95·8 p.c. "

I have the honour to be, sir,

Your obedient servant,

THOMAS MACFARLANE,

Chief Analyst.

RESULTS of examining 169 Samples of

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Quantity.	Cost.	Name and Address of Manufacturer or Furnisher as given by Vendor.
1902		*District of Halifax.*		$ cts.	
July 31	4311	Finnell and Chandler, Charlottetown, P.E.I			Lewis Berger & Sons
" 31	4312	Cawell Bros., Charlottetown, P.E.I			"Lion Brand"
Aug. 6	20226	T. P. Collins, Kentville, N.S			Canada Paint Co., Montreal, Que.
" 11	20231	J. R. Rawley, Halifax, N.S			A. B. Ansbacher, New York
" 23	17844	A.C. Smith & Co., St. John, N.B			J. Pfeiffer, New York, N.Y
" 23	17845	George A. Moore, St. John, N.B			Canada Paint Co., Montreal
" 21	23331	J. E. Marceau et Frère, Lac Mégantic, Quebec			" "
" "	23337	S. Bourgeois, St. Hyacinthe, Que			Lewis Berger & Sons, London, Eng
" 2	21222	Palascio Hardware Co., 1901, Notre Dame St., Montreal			Canada Paint Co., Montreal
" 22	21223	L. Lafleur, 1932 Notre Dame St., Montreal			A. B. Ansbacher, New York
" 23	21227	John Corbett, Princess St., Kingston			L. Pfeiffer, New York
" 23	21228	W. A. Mitchell, Princess St., Kingston			Canada Paint Co., Montreal
" 21	22053	C. E. Nasmith, Stratford, Ont			
" 22	22036	W. D. Rougoic, Goderich, Ont			Saunders & Pearcy, Toronto
" 31	17423	W. Wyatt, Winnipeg, Man			John Lucas & Co., New York
" 31	17425	Campbell & Son, "			P. B. Dodd & Co., Montreal
" 28	21680	C. Nelson, Vancouver, B.C			A. B. Ansbacher, New York
" 28	21681	E. S. Knowlton, Vancouver, B.C			J. Pfeiffer, New York
	Special.	Cawell Bros., Charlottetown, P.E.I			Sent by Vendors
1903		*District of Halifax.*			
April 16	20241	C. C. Richards, Yarmouth, N.S	3 bots	0 45	Canada Paint Co., Montreal
" 20	20262	R. B. Lakin, Windsor, N.S	3 "	0 25	" "
" 21	20265	Duriock & Armstrong, Windsor	3 "	0 20	Lewis Berger & Sons, London, Eng
" 21	20266	Wilcox Bros., Windsor, N.S	3 "	0 25	" "
" 22	20304	Crowe Bros., Truro, N.S	3 "	0 25	" "
" 28	20314	Hattie & Mylins, Halifax, N.S	1 lb	0 30	Canada Paint Co., Montreal
" 28	20315	Black Bros., Halifax	1 "	0 20	" "
" 28	20316	A. M. Bell, Halifax	1 "	0 20	A. B. Ansbacher & Co., Chicago.
" 30	20320	Crowell Bros., Halifax	1 "	0 20	" "
" 30	20321	C. E. Huggins, Halifax	1 "	0 20	Simson Bros., Halifax.
" 30	20323	R. McFatridge, Halifax	1 "	0 25	Canada Paint Co., Montreal
" 30	20326	W. H. Stevens, Dartmouth	3 pkgs	0 30	Hattie & Mylius, Halifax
" 30	20329	Jas. Simmonds & Co., Dartmouth	"	0 25	Canada Paint Co., Montreal
May 1	20331	G. H. Colwell, Halifax	3 "	0 40	Brown & Webb, Halifax
" 1	20332	H. A. Taylor, Halfax	3 "	0 30	Canada Paint Co., Montreal
" 1	20334	Simson Bros., Halifax	3 "	0 25	" "
April 20	4329	R. I. Holman, Summerside	3 cans	0 60	
" 20	4330	F. W. Strong, Summerside	3 "	0 60	
" 21	4333	S. W. Crabbe, Charlottetown	3 "	0 54	
" 22	4335	D. Gordon, Georgetown	3 "	0 66	
" 22	4337	John Knight, Georgetown	3 "	0 60	
		District of New Brunswick.			
" 13	17864	P. Nase & Son, Main St., St. John	3 cans.	0 75	Canada Paint Co., Montreal
" 13	17865	McMulkin & Jordan, Main St., St. John	3 "	0 75	J. Pfeiffer, New York
" 14	17866	George A. Moore, 109 Brussel St., St. John.	3 "	0 75	" "

SESSIONAL PAPER No. 14

Paris Green as sold in 1902–3.

Results of Analysis.					Name of Analyst and Remarks.	No. of Sample.
Cupric Oxide	Arsenious Acid.	Acetic Anhydride.	Moisture.	Solubility in Ammonia.		
p.c.	p.c.		p.c.			
29·00	51·32	Undetermined.			Genuine	4311
7·00	20·20	"		Much residue	Adulterated contains 60·4 p.c. of barium and green coloring matter soluble in methy-alcohol	4312
29·81	54·30	"			Genuine	20226
30·50	53·60	"			"	20231
30·40	53·00	"			"	17844
30·50	55·89	"			"	17845
30·20	50·48	"			"	23331
30·40	50·61	"			"	23337
30·06	51·88	"			"	21222
29·70	54·00	"			"	21223
31·15	51·42	"			"	21227
30·20	52·50	"			"	21228
31·90	53·50	"			"	22033
31·50	54·20	"			"	22036
30·26	54·79	"			"	17423
31·80	57·62	"			"	17425
31·00	56·92	"			"	21680
30·40	54·81	"			"	21681
30·80	52·39	"			"	Spec. 4.
31·02	55·56	"	1·07	No residue.	M. Bowman, unadulterated.	20241
30·19	52·57	"	2·01			20262
31·95	54·17	"	1·16			20263
31·73	53·54	"	1·16			20266
31·88	53·64	"	1·01			20304
30·52	55·25	"	0·87	No residue.		20314
30·74	55·91	"	2·12			20315
31·63	54·96	"	1·48	"		20316
31·46	54·35	"	1·44	"		20320
31·07	55·10	"	1·31			20321
31·07	53·61	"	1·23	"		20323
30·53	54·77	"	1·23	"		20326
31·15	54·16	"	2·29			20329
32·38	54·44	"	1·09	"		20331
31·55	54·41	"	1·31			20332
31·57	54·43	"	1·22	"		20334
32·05	55·22	"	1·16			4329
31·26	55·22	"	0·95	"		4330
undetermined.	undetermined.	"	0·48	Large residue of barytes.	adulterated with 65·44 p.c. of barytes and green coloring matter	4335
31·75	55·03	"	1·17	No residue.	M. Bowman, unadulterated.	4335
30·62	53·83	"	1·06	"	"	4337
30·50	51·17	Undetermined.	Undetermined.	Complete.	Alph. Lemoine; unadulterated	17864
31·30	55·13	"	"			17865
30·70	53·35	"			"	17866

RESULTS of examining 169 Samples of

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Quantity.	Cost.	Name and Address of Manufacturer or Furnisher as given by Vendor.
1903.		*District of New Brunswick*—Con.		$ cts.	
April 15	17873	W. H. Thorne Co., Ltd., St. John.....	3 "	0 45	Canada Paint Co., Montreal. ...
" 15	17874	T. B. Barker & Sons, 57-59 Dock St., St. John.	3 "	0 60	" " .....
" 16	17877	W. B. MacKay & Co., Main St., Sussex	3 "	0 75	E. J. Barry, 18 Cliff St., New York
" 16	17881	Sussex Mercantile Co., Main St., Sussex	3 "	0 54	Canada Paint Co., Montreal.....
" 17	17889	The Sumner Co., Main and Wesley Sts., Moncton.	3 "	0 75	J. Pfeiffer, New York..... ....
" 17	17890	Robertson & Givan, Main and Duke Sts., Moncton.	3 "	0 66	Canada Paint Co., Montreal.....
" 18	17894	Winter & Co., 282 Main St.; Moncton..	3 "	0 75	Lewis Berger & Sons, London, Eng.
" 21	17899	Fred. E. Rose, King St., St. Stephen..	3 "	0 75	J. Pfeiffer, New York.....
" 21	17900	DeWolfe Hardware Co., King St., St. Stephen.	3 "	0 60	Canada Paint Co., Montreal....
" 23	17905	A. E. Jones, King St., Woodstock	3 "	0 60	" " .....
" 23	17906	W. F. Diblee & Son, Main St., Woodstock.	3 "	0 60	" " .....
" 25	17917	Geo. Y. Diblee, Queen St., Fredericton	3 "	0 75	Lewis Berger & Sons, Eng .....
" 25	17919	Tweedale & Co., Queen St., Fredericton	3 "	0 75	J. Pfeiffer, New York..... ...
		District of St. Hyacinthe.			
" 17	23341	Raymond et Frères, St. Hyacinthe.....	1½ lbs.	0 30	Vendors.....
" 20	23347	Victor Trudeau, St. Lambert.....	10½ oz.	0 10	.....
" 21	23351	A. Bergeron, Iberville, Que	1 lb	0 20	Lewis Berger & Sons, Eng .....
" 21	23354	Coté et Frères, St. Johns, Que	1 "	0 25	Canada Paint Co., Montreal.....
" 22	23361	W. Campbell, Lacolle.....	2 lbs.	0 40	Howden Starke & Co., Montreal.
" 22	23365	John Hunter, Lacolle.....	1 "		A. Ramsay & Son.....
" 23	23369	H. R. Thompson, Ulverton	1 lb.	0 20	Canada Paint Co., Montreal ....
" 23	23367	A. Allard, Lachine.....	12 oz.	0 15	Kavanagh & Co., Montreal.....
May 1	23389	Thos. Lapointe, Terrebonne.....	1 lb.	0 20	Canada Paint Co., Montreal....
" 13	23390	Simeon Papillan, Notre Dame de St. Hyacinthe.	1 "	0 25	Lewis Berger & Sons, Eng ..
" 13	23392	Victor Gervais, St. Hyacinthe.....	1 "	0 25	Canada Paint Co., Montreal.....
" 13	23395	Jos. Leduc, St. Hyacinthe.....	1 "	0 25	Lewis Berger & Sons, Eng .....
" 14	23397	P. C. Lemoine, Sorel.....	1 "	0 25	.....
" 13	23400	J. O. Fagnan, Sorel.....	1 "	0 25	A. B. Ansbacher & Co .....
" 14	23602	A. C. Trempe, Sorel	1 "	0 20	Canada Paint Co., Montreal.....
" 15	23603	J. B. St. Pierre, St. Hyacinthe.....	1 "	0 25	L. B. Hibert, Montreal..... ..
		District of Montreal.			
" 8	21255	A. E. Breyent, 1786 St. Catherines St..	2 pkgs.	0 30	L. Berger & Sons, Eng..... ...
" 8	21256	C. Roussin, 1719 St. Catherines St.....	1 lb ...	0 25	Canada Paint Co., Montreal.....
" 8	21257	Wilson, Rousseau & Co., 167 St. Lawrence St.	1 " ...	0 25	" " .....
" 8	21258	E. D. Colleret & Co., 26 St. Lawrence St.	1 " ...	0 25	.....
" 8	21259	A. Beaudoin, St. Lawrence St., Montreal	1 " ...	0 25	B. Ansbacher & Co .....
" 9	21260	Dr. G. Demer, 2185 Notre Dame St....	1 " ...	0 30	.....
" 12	21261	L. A. Lambert, 218 St. Paul St., Montreal.	.....	0 18	Lewis Berger & Sons, Eng ....

SESSIONAL PAPER No. 14

Paris Green as sold in 1902–3—*Continued.*

Results of Analysis.					Name of Analyst and Remarks.	No. of Sample.
Cupric Oxide.	Arsenious Acid.	Acetic Anhydride.	Moisture.	Soluble in Ammonia.		
p. c.	p. c.	p. c.	p. c.			
30·20	52·76	Undetermined.	Undetermined.	Complete.	Alph. Lemoine; unadulterated.	17873
29·70	53·39	"	"	"	"	17874
29·60	55·07	"	"	"	"	17877
30·90	50·70	"	"	Slight residue...	Miss E. Davidson	17881
31·10	50·35	"	"	"	"	17889
31·40	50·06	"	"	Complete.	"	17890
31·70	53·83	"	"	"	"	17894
31·00	54·20	"	"	"	Alph. Lemoine	17[illegible]
30·70	54·26	"	"	"	"	17[illegible]
29·50	53·50	"	"	"	"	17905
30·20	53·20	"	"	"	"	17906
29·70	53·60	"	"	"	"	17917
30·10	53·89	"	"	"	"	17919
29·80	53·70	"	"	"	"	23341
30·30	52·05	"	"	Slight residue	Alph. Lemoine; unadulterated, but mixed with small cakes of a mixture of paris green and oxide of iron, the latter evidently derived from a previous containing vessel.	23347
31·40	54·12	"	"	Slight sediment.	Miss E. Davidson; genuine.....	23351
30·90	54·77	"	"	Complete.....	"	23354
11·70	41·45	"	"	26·70 p.c. sediment.	Alph. Lemoine; adulterated with barytes.	23361
31·00	53·87	"	"	Slight sediment.	Miss E. Davidson; genuine.....	23365
30·00	55·47	"	"	Complete.....	"	23369
[illegible]	[illegible]	[illegible]	"	Much sediment.	"	23367
29·80	54·08	"	"	Complete....	"	23389
31·70	55·87	"	"	"	Alph. Lemoine; unadulterated	23390
30·90	54·39	"	"	"	"	23392
30·60	54·14	"	"	"	"	23395
31·40	52·13	"	"	"	"	23397
29·30	53·39	"	"	"	"	23400
29·50	53·02	"	"	"	"	23402
30·30	54·51	"	"	"	"	23403
32·69	55·69	Not determined.	0·80	Practically complete.	Dr. J. T. Donald, Montreal; genuine..	21255
32·07	52·99	"	0·76	"	"	21256
32·07	55·56	"	0·79	"	"	21257
31·80	53·80	"	0·59	"	"	21258
31·35	54·99	"	0·94	"	"	21259
21·60	26·79	"	0·57	28·2 p.c. insoluble in ammonia.	Dr. J. T. Donald; contains 10·84 p.c. barytes, also terra alba or plaster of paris = 13·89 p.c.; adulterated with barytes and sulphate of lime.	21260
31·00	54·28	"	0·75	Practically complete.	Dr. J. T. Donald; genuine.....	21261

RESULTS of Examining 169 Samples of

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Quantity.	Cost.	Name and Address of Manufacturer or Furnisher as given by Vendor.
1903.		*District of Montreal*—Con.		$ cts.	
May 8	21262	A. A. Wilson, 219 St. Paul St.	1 lb	0 20	
" 6	21263	Keddy & Kenny, Hemmingford, Que.	1 "	0 20	Lewis Berger & Sons, Eng
" 6	21264	John McFee, Hemmingford	1 "	0 20	Canada Paint Co., Montreal.
" 6	21265	J. V. Amyrauld, Hemmingford	1 "	0 25	Howden, Starke & Co.
" 7	21266	C. Bisson, St. Vincent de Paul	1 "	0 20	Sherwin-Williams Paint Co., Montreal.
" 7	21267	V. Auclair, St. Vincent de Paul	1 lb	0 25	A. Ramsay & Son
" 7	21268	W. P. Brennan, St. Thérèse	1 "	0 20	
" 7	21269	G. L. Meikle & Co., Lachute	1 "	0 25	
7	21270	H. Tracer, jr., Lachute	1 "	0 25	E. J. Barry, New York.
		District of Kingston.			
April 21	23173	A. C. Miller, King St., Brockville	1 lb	0 20	
" 21	23174	R. H. Stuart, King St., Brockville	3 pkgs.	0 30	Jno. Lucas & Son
" 21	23175	J. Williams, Brockville	1 lb	0 25	
" 21	23176	F. R. Curry, King St., Brockville	1 "	0 25	P. D. Woods & Co.
" 21	23177	V. T. Kincard, King St., Brockville	3 pkgs.	0 38	Canada Paint Co., Montreal.
" 22	23178	R. W. Ross & Co., Prescott, Ont.	1 lb	0 20	Lewis Berger & Sons, England
" 22	23179	A. A. Harding, Prescott, Ont	1 "	0 25	Lyman, Sons & Co
" 21	23167	A. Strachan, Princess St., Kingston	1 "	0 25	Jno. Lucas & Son.
" 21	23168	Walton & Strange, Princess St., Kingston	1 "	0 25	Canada Paint Co., Montreal.
" 21	23169	G. W. Mahood, Princess St., Kingston.	1 "	0 35	
" 21	23170	H. B. Taylor, Kingston	1 "	0 30	
" 21	23171	H Wade, King St., Kingston	3 pkgs.	0 38	Jno. Lucas & Son
" 21	23172	E. Ebells, King St., Kingston	1 lb	0 25	Canada Paint Co., Montreal.
" 30	23180	C. A. McHaffer, Cornwall, Ont.	1 "	0 35	Sherwin-Williams Paint Co.
" 30	23181	E. H. Brown, Cornwall, Ont	1 "	0 25	Lyman, Sons & Co., Montreal.
" 30	23182	H. Pitts, Cornwall, Ont.	1 "	0 25	Canada Paint Co., Montreal.
		District of Toronto.			
April 16	23451	Wm. Crossland, Barrie, Ont	1 lb	0 25	
" 16	23452	H. G. Robertson, Barrie, Ont	1 "	0 25	Nobbs Hardware Co.
" 17	23453	Thomas Ramsay, Hamilton.	1 "	0 20	
17	23454	Parke & Parke, Hamilton.	1 "	0 20	
" 17	23455	H. E. Hawkins, King St., Hamilton	1 "	0 20	Dominion Drug Co.
" 17	23456	John Mack, James St., Hamilton	1 "		
" 17	23457	J. A. Zimmerman, King St., Hamilton.	1 "	0 25	
" 17	23458	Wood, Valance & Co., Hamilton.	3 pkgs.	0 30	
" 17	23459	" " "	3 "	0 30	John Lucas & Co.
" 17	23460	G. W. Spackman, Market Sq., Hamilton	3 "	0 25	L. Berger & Sons, England.
" 18	23461	A. Stewart, Guelph, Ont	1 lb	0 20	
" 18	23462	W. Herod, Guelph, Ont	1 "	0 20	
" 18	23463	A. B. Petrie, St. Catharines	1 "	0 20	
" 18	23106	P. Dwyer, Guelph, Ont.	1 "	0 25	
" 18	23107	McEdward & Moon, Guelph, Ont.	1 "	0 25	
" 18	23108	H. Southcott, Guelph, Ont	1 "	0 25	John Lucas & Son.
		District of London.			
April 16	22067	Peter Hynman, Berlin, Ont	1 lb	0 25	Canada Paint Co., Montreal.
" 17	22071	Gies Wolfhard & Co., Berlin	1 "	0 25	Vendors
17	22072	Theron Buchanan, Galt, Ont	1 "	0 30	Steele & Wood, Toronto

Paris Green as sold in 1902–3.—*Continued.*

Results of Analysis.					Name of Analyst and Remarks.	No. of Sample.
Cupric Oxide.	Arsenious Acid.	Acetic Anhydride.	Moisture.	Solubility in Ammonia.		
p. c.	p. c.	p. c.	p. c.			
31·85	55·29	Not determined.	0·58	0·25 p.c. insoluble in ammonia.	Dr. J. T. Donald; genuine	21262
31·30	53·51	" ..	0·95	Practically complete.	" "	21263
30·51	53·97	" ..	1·06	" ..	" "	21264
30·78	52·99	" ..	1·20	" ..	" "	21265
30·69	54·11	" ..	0·88	" ..	" "	21266
29·35	53·20	" ..	1·02	Practically complete.	" "	21267
30·95	53·93	" ..	1·15	" ..	" "	21268
32·07	53·68	" ..	1·47	" ..	" "	21269
31·04	53·99	" ..	0·83	" ..	" "	21270
30·30	53·52	Undetermined.	Undetermined.	Complete	Alph. Lemoine; unadulterated	23173
31.30	54·63	" ..	" ..	"	" "	23174
31·40	55·20	" ..	" ..	"	" "	23175
31·50	56·74	" ..	" ..	"	" "	23176
30·50	54·14	" ..	" ..	"	" "	23177
31·60	55·81	" ..	" ..	"	" "	23178
30·70	53·77	" ..	" ..	"	" "	23179
30·10	54 39	" ..	" ..	"	" "	23167
30·20	54·94	" ..	" ..	"	" "	23168
31·80	55·94	" ..	" ..	"	" "	23169
31 00	54·95	" ..	" .	"	" "	23170
29·20	54·32	" ..	" ..	"	" "	23171
30·00	55·32	" ..	" ..	"	" "	23172
30·60	55·19	" ..	" ..	"	" "	23180
31·10	54·51	" ..	" ..	"	" "	23181
30·40	55·06	" ..	" ..	"	" "	23182
30.04	55·52	9·71	0·95	Complete	Dr. W. H. Ellis; unadulterated	23451
29·18	51·28	9·71	0·93	"	" "	23452
30·26	51·96	9·94	0·88	"	" "	23453
27·28	54·77	8·36	0·54	Trace insoluble.	Dr. W. H. Ellis; contains too little copper and too much arsenious acid: contains free arsenious acid.	23454
30·40	54·01	9·04	0·65	Complete	Dr. W. H. Ellis; unadulterated	23455
30·53	50·66	9·26	0·80	"	" "	23456
32·37	52·79	9·15	0·67	3·40 p.c. insoluble	" "	23457
30·28	52·53	9·37	0·68	Complete	" "	23458
30·54	52·38	9·15	0·81	"	" "	23459
31·52	53·25	8·70	0·81	Trace insoluble.	" "	23460
31·29	52·85	9·37	0·82	"	" "	23461
27·95	58·15	9·04	0·82	"	Dr. W. H. Ellis; composed of paris green with excess of arsenious acid.	23462
31·58	53·79	9·92	0·90	Complete	Dr. W. H. Ellis; unadulterated	23463
30·46	52·58	9 15	0·64	0·23 p.c. insoluble	" "	23106
31·49	52·73	9·83	0·72	Trace insoluble.	" "	23107
31·28	52·85	9·49	0·90	"	" "	23108
31·10	55·01	Undetermined.	Undetermined.	Complete	Alph. Lemoine; genuine	22067
31·60	55·32	" ..	" .	"	" "	22071
31·60	54·08	" ..	" ..	"	" "	22072

RESULTS of examining 169 Samples of

Date of Collection.	No. of Sample.	Name and Address of Vendor.	Quantity.	Cost.	Name and Address of Manufacturer or Furnisher as given by Vendor.
1903.		*District of London*—Con.		$ cts.	
" 21	22081	James Wilson & Bros., Windsor, Ont.	1 "	0 25	Canada Paint Co., Montreal.
" 21	22082	D. L. Wigle & Son, Windsor, Ont.	1½ lbs.	0 38	" "
" 21	22084	Worbent, Clinton & Batter, Windsor, O.	3 tins.	0 15	D. H. Howden, London, Ont
April 22	22086	Westman Bros., Chatham, Ont.	1 lb.	0 25	Vendors
			3 cups	0 15	
" 22	22089	A. H. Patterson "	1 lb.	0 20	Toronto Lead & Colour Co
			3 cups.	0 15	
" 22	22092	D. Machlan, Glencoe, Ont.	3 pots.	0 40	David Howden, London.
" 23	22094	A. Westman, London, Ont	1½ lbs.	0 30	J. Pfeiffer, New York.
" 24	22101	T. W. Dunn, Ingersoll, Ont.	1 lb.	0 25	Canada Paint Co., Montreal.
" 24	22102	Robertson & McKay, Ingersoll, Ont.	1½ lbs.	0 35	Lewis Berger & Sons, Eng.
" 24	22103	James Cown, London, Ont	1 lb.	0 25	John Lucas & Co., Philadelphia
" 24	22104	James Reid "	1 "	0 20	Vendor.
a 24	22107	J. C. Grefin, St. Mary's	1½ lbs.	0 30	Canada Paint Co., Montreal.
		District of Winnipeg.			
" 21	17446	J. B. Cain, Virden	1½ "	0 60	Canada Paint Co., Montreal.
" 24	17454	Brown & Mitchell, Brandon.	1 lb.	0 35	
May 6	17461	Anderson & Thomas, Winnipeg.	1 "	0 30	G. F. Stevens & Co., Winnipeg
" 6	17462	C. A. Baskerville & Co., Winnipeg.	1 "	0 35	Canada Paint Co., Montreal.
" 6	17463	J. H. Ashdown & Co., "	1 "	0 30	" " "
" 6	17470	N. H. Jackson, Winnipeg.	1 "	0 40	Dominion Drug Co., Hamilton
" 6	17473	W. R. Inman "	1 "	0 35	Canada Paint Co., Montreal.
" 6	17474	Payntz & Co. "	1 "	0 50	Bole Drug Co., Winnipeg.
" 6	17475	Graham & Robston, Winnipeg.	1 "	0 30	Canada Paint Co., Montreal.
" 6	17476	W. A. Templeton "	1 "	0 25	A. Ramsay & Son., Montreal.
		District of Manitoba.			
April 26	21731	Cawker & Son, Medicine Hat.	1 "	0 60	
" 27	21734	F. Nichol, Lethbridge.	1 "	0 65	Martin Bole & Wynne, Winnipeg
" 27	21735	Higinbotham, Lethbridge, Man	1 " "	0 60	Canada Paint Co., Montreal.
" 28	21737	A. Young & Co., McLeod, Man.	1 "	0 50	Bole Drug Co., Winnipeg
" 29	21740	C. Wallace, Calgary.	1 "	0 75	B. Ansbacher & Co., New York
" 29	21741	W. McLean "	1 "	0 40	Evans & Co., Montreal.
" 29	21742	Owen Both "	1 "	0 65	Martin Bole & Wynne, Winnipeg
" 29	21743	James Findley "	1 "	0 50	Lyman Sons & Co., Montreal.
		District of British Columbia.			
" 16	21689	Coulter & Berry, Langley, B.C	1½ "	0 55	Henderson Bros., Vancouver.
" 16	21692	H. Alder, Mt. Lehman, B.C.	14 ozs	0 35	
" 17	21698	H. C. Henderson, Chilliwack, B.C.	1½ lbs.	0 60	McDonnell, Aitken, Watson Co., Vancouver.
" 17	21700	G. R. Ashwell & Sons, Chilliwack, B.C.	1½ "	0 55	Henderson Bros., Vancouver.
" 17	23506	Baiker & Henderson "	1½ "	0 50	Nelson, McPherson, Sutherland Drug Co.
" 18	23513	J. Plumridge, Mission, B.C.	1½ "	0 45	
" 18	23524	Marshall Smith, Ladner's Landing.	3 "	0 45	Wood's, Ladner's Landing
" 18	23526	F. J. McKenzie "	1½ "	0 75	
" 18	23532	Hall & Co., Victoria, B.C.	3 "	1 50	J. H. Winer, Hamilton.
" 18	23533	Dean & Hiscocks "	1½ "	0 75	Henderson Bros., Vancouver.
" 18	23534	C. H. Bow "	2½ "	1 00	Canada Paint Co., Montreal.
" 18	23535	Davies Bros. "	1½ "	0 75	Henderson Bros.
" 27	23543	C. Nelson, Vancouver, B.C.	3 "	1 50	A. B. Ansbacher & Co., New York.
" 27	23544	C. Woodman "	2 "	0 50	
" 28	23547	G. T. Burnett, New Westminster	1½ "	0 75	
" 28	23550	H. Ryall, New Westminster.	1½ "	0 60	Henderson Bros., Vancouver.

Paris Green as sold in 1902–3—*Continued.*

Results of Analysis.					Name of Analyst and Remarks.	No. of Sample.
Cupric Oxide.	Arsenious Acid.	Acetic Anhydride.	Moisture.	Solubility in Ammonia.		
p. c.	p. c.	p. c.	p. c.			
30·80	54·82	Undetermined.	Undetermened.	Complete.....	Alph. Lemoine; genuine.....	22081
29·90	54·75	" ..	" ..	"	" "	22082
30·10	54·39	" ..	" ..	"	" "	22084
31·60	54·82	" ..	" ..	"	" "	22086
30·10	53·89	" ..	" ..	"	" "	22089
29·40	54·44	" ..	" ..	"	" "	22092
31·20	55·56	" ..	" ..	"	" "	22094
29·30	53·89	" ..	" ..	"	" "	22101
30·50	54·14	" ..	" ..	"	" "	22102
31·10	55·50	" ..	" ..	"	" "	22103
28·30	53·27	" ..	" ..	"	" "	22104
29·90	54 26	" ..	" ..	"	" "	22107
31·77	57·60	" ..	1·34	.....	Prof. E. B. Kenrick, Winnipeg; genuine.	17446
28·88	56·99	" ..	1·55	.....	" " " ..	17454
31·90	57·77	" ..	1·15	.....	" " " ..	17461
31·85	57·58	" ..	1·39	.....	" " " ..	17462
32·11	57·61	" ..	1·12	.....	" " " ..	17463
28·43	61·62	" ..	1·39	.....	" " " ..	17470
32·17	57·74	" ..	1·13	.....	" " " ..	17473
31·93	57·63	" ..	1·14	.....	" " " ..	17474
31·61	57·73	" ..	0·75	.....	" " " ..	17475
31·73	57·50	" ..	1·11	.....	" " " ..	17476
32·24	57·65	" ..	1·14	.....	" " " ..	21731
31·60	56·94	" ..	1·25	.....	" " " ..	21734
32·00	56·90	" ..	1·16	.....	" " " ..	21735
31·87	57·53	" ..	1 16	.....	" " " ..	21737
30·33	56·56	" ..	1 34	.....	" " " ..	21740
30·65	57·47	" ..	0·90	.....	" " " ..	21741
30·60	56·96	" ..	1·17	.....	" " " ..	21742
31·16	57·02	" ..	1·25	.....	" " " ..	21743
29·12	58·40	" ..	1·4	Traces insoluble.	Dr. C. J. Fagan, Victoria. B.C.; genuine..	21689
28·86	58·10	" ..	1·4	None insoluble..	" " " ..	21692
28·86	58·10	" ..	1·1	" ..	" " " ..	21698
29·12	57·50	" ..	1·38	" ..	" " " ..	21700
28·86	58·10	" ..	1·08	" ..	" " " ..	23506
29·12	56·90	" ..	1·44	" ..	" " " ..	23513
28·52	57·70	" ..	1·26	" ..	" " " ..	23524
28·34	58·10	" ..	1·44	" ..	" " " ..	23526
27·56	57·40	" ..	1·12	" ..	" " " ..	23532
28·08	56·90	" ..	1·22	" ..	" " " ..	24533
27·82	56·60	" ..	1·30	" ..	" " " ..	23534
28·08	56·40	" ..	1·14	" ..	" " " ..	23535
28·52	56·40	" ..	1·30	" ..	" " " ..	24543
28·52	56·40	" ..	1·30	" ..	" " " ..	23544
28·86	56·40	" ..	1·46	" ..	" " " ..	23547
28·52	56·60	" ..	1·26	" ..	" " " ..	23550